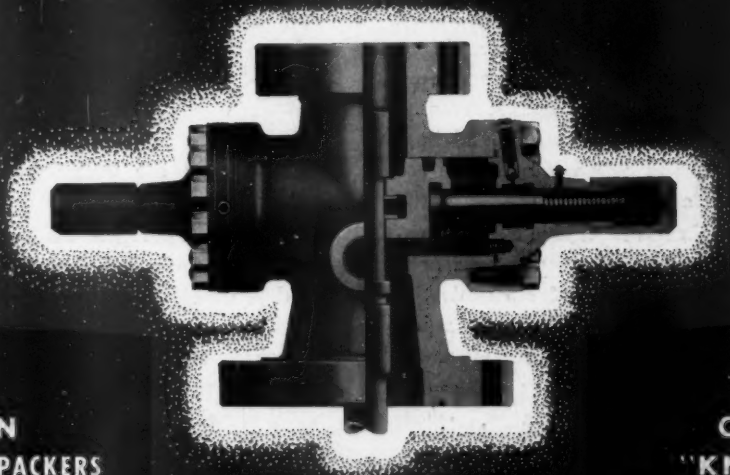
NOV 19 1943

the OIL AND GAS JOURNAL

Key to Successful

DUAL COMPLETIONS

CAMERON RAM-TYPE TUBING CONTROL HEADS



Plus

CAMERON

POSITIVE SEALING PACKERS

Circulating Anchor Type to provide a dependable seal between producing zones; Cross-Over Type to divert production from an upper sand thru the tubing.

Plus

CAMERON

"KNOW-HOW"

Field men, experienced in several methods of multi-zone completion, are at your service in most active domestic areas.

The Cameron field service organization and engineering staff, in collaboration with a number of oil producers who, several years ago, foresaw the tremendous economic possibilities of dual completions, is credited with much of the pioneering and early development of dual completion operations.

The unique Cameron "Closed Pressure Method of Well Completion" and equipment originally designed to provide greater safety in completing deep, high pressure, single zone wells, proved itself equally advantageous in multi-zone completion operations.

Operators contemplating work of this nature are invited to make use of Cameron's rich backlog of experience gained from extensive multi-zone completion operations.

CAMERON IRON WORKS, INC.

711 MILBY STREET, HOUSTON, TEXAS

Export: 74 Trinity Place, New York, N. Y. *California:* The Howard Supply Co., Los Angeles.
Rocky Mountain: Mountain Sales & Service, Casper, Wyo.

More Than 200 Multi-zone Completions to Our Credit

PRICE 20 CENTS

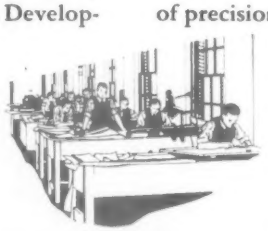
NOVEMBER 18, 1943

The Seed of Today is the Tree of Tomorrow

HE who has longed for the cool shade of a mighty oak in his front lawn, or for a row of productive fruit trees in the back yard—this man knows that the planting of the seed must, by many years, precede the fulfillment of his dreams.

So it is with the attainment of life's goals—a home, position and independence. So it is with the United Nations today in their quest for the four Freedoms. The seed for a sturdy tree of world security was planted the day we and our Allies went all-out against tyranny. It has taken a while for our tree to mature and bear fruit, but because we moved when we did we are assured of success in the eventual victory.

While we in the Pittsburgh Equitable Meter Company and Merco Nordstrom Valve Company are now chiefly engaged in the production of materials for winning this war, we are also energetically planning for the future. The Research, Engineering and Development programs of our organization are being intensified. New designs are taking form on the drawing boards. Experiments with new materials and new models are taking place in the laboratories. Our Standards Department, which was recently awarded the "A" Rating for quality control by the U. S. Army Air Forces, will apply exacting precision over the manufacturing procedure in our products of tomorrow.



FROM TODAY'S RESEARCH AND PLANNING WILL COME OUR PRODUCTS OF TOMORROW

With the coming of world peace, our five factories will resume their principal role of building accurate and dependable meters, valves, regulators and similar items for measurement and control. As manufacturers of precision equipment, we expect the educated post-war buyer to demand and recognize only the highest quality and serviceability. In the end, the harvest of the seeds that we are sowing today will be garnered by the equipment users of tomorrow.

PITTSBURGH EQUITABLE METER COMPANY

BOSTON · BROOKLYN · BUFFALO · CHICAGO · COLUMBIA · HOUSTON · KANSAS CITY

MERCO NORDSTROM VALVE COMPANY

Main Offices, Pittsburgh, Pa

LOS ANGELES · MEMPHIS · NEW YORK · PITTSBURGH · SAN FRANCISCO · SEATTLE · TULSA

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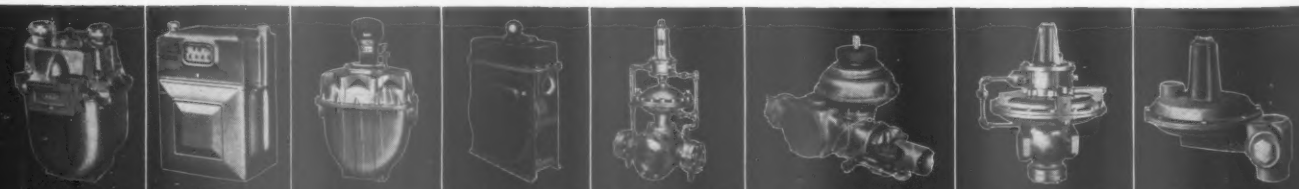
BACK THE ATTACK WITH WAR BONDS

EMCO METERS AND REGULATORS



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the OIL AND GAS JOURNAL

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General Heading: BAKER ROTARY WALL SCRAPER

Unit No. A-28

Subject: Scraping Cement Off Producing Zone

Awarded to Los Angeles Plant—1943

BAKER OIL TOOLS, INC.
Main Office and Factory:
6000 So. Boyle Ave., Box 127, Vernon Station, Los Angeles, Calif.
Central Division Office and Factory:
6023 Navigation Blvd., Box 2048, Houston, Texas
Export Sales Office:
19 Rector Street, New York, N. Y.

Index: 250.1
Date: November 18, 1943
Page: 1

Of the many practical field applications for the Baker Wall Scraper, cleaning up oil sands is one of the most important. In such applications, the amount of actual hole enlargement varies according to the character and thickness of the substance to be removed.

Where only the mud cake is to be scraped off the oil sand, usually a cut of approximately an inch or less is sufficient. In other cases, where both cement and formation is to be removed, it may be necessary to enlarge the hole a number of inches such as in the job illustrated below.

REPORT ON BAKER WALL SCRAPER

Date 1942

Company X X X X

Field Midway, Arkansas Well and Lease X X X

Person in Charge X X X Position X X X

Depth of Well 6453' Circulating Fluid (mud or oil) Mud

Size of Casing Run Through 5½" Depth 6410'

Size of Scraper Used 2" Size of Blades 9"

Were Blades Factory Built? Yes Outside Rebuilt?

No. of Blades Used 1 pair Condition After Use Good

Nature of Formation Producing Zone

Size of Hole Before Scraping 4¾" After 9"

Distance Scraped 41' From 6412' To 6453

Condition of Scraper After Use Good

Time Consumed on Each Run 9 Hours

Was Scraper Satisfactory in Performance? Yes

NATURE OF JOB: (Check Below)

Producing:
1. Cleaning Oil Sands ✓
2. Setting Liners

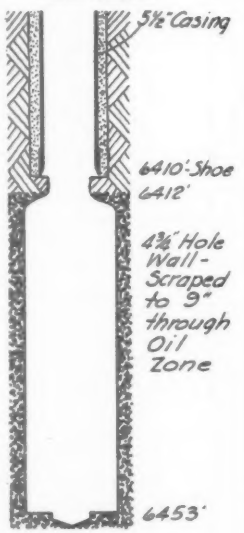
Drilling:
1. Sidetracking
2. Straightening Hole
3. Whipstocking

Cementing:
1. Bottlenecking
2. Setting Cement Plug

Running Casing:
1. Cleaning Hole to Gauge

Other Operations:

Sketch of the Job



Detail of Job and Practical Results Scraping Cement off Producing Zone

Reported By Courtney J. Berlin

Product No. 500
Baker Rotary Wall Scraper

Features Which Make the *BAKER ROTARY WALL SCRAPER* A DEPENDABLE TOOL:

(1) Double Pin Drill Collar — Connects Wall Scraper Body to drill collar.

(2) Circulation Screen — Design of cone-shaped Screen minimizes abrasive action of fluid and prevents debris from clogging circulation passages.

(3) Wall Scraper Body — Machined out of a solid piece of special alloy steel . . . provides great strength.

(4) Plunger Head — Provided with oil resistant Seals to prevent fluid by-pass and insure Piston efficiency . . . Blades will Positively Open.

(5) Plunger Spring—Strong Plunger Spring insures proper closing of blades.

(6) Bushing (Circulation Bean) — Fluid is directed on each blade, lubricating and cooling cutting surfaces.

(7) Hinge Pin — Machined from solid piece of special alloy steel.

(8) Blades — Machined from special alloy steel forgings . . . afford toughness and hardness. Cutting edges are hard-faced and set with Tungsten Carbide Inserts. Long bearing surface on blades minimizes "corkscrewing."

(9) Blade Expansion — Amazing reaming capacity provided by expansion range of Cutter Blades from 4" to 36".

the OIL AND GAS JOURNAL

Trends

Crude-Oil Production By States—Page 76

CRUDE-OIL STOCKS 236,937,000 bbl. as of Nov. 6—down 282,000 bbl. One year ago 236,198,000 bbl.

GASOLINE STOCKS 68,698,000 bbl. as of Nov. 6—down 599,000 bbl. One year ago 76,335,000 bbl.

RESIDUAL FUEL-OIL STOCKS 63,551,000 bbl. as of Nov. 6—down 287,000. One year ago 79,057,000.

GAS OIL AND DISTILLATE 44,776,000 as of Nov. 6—up 185,000 bbl. One year ago 49,793,000 bbl.

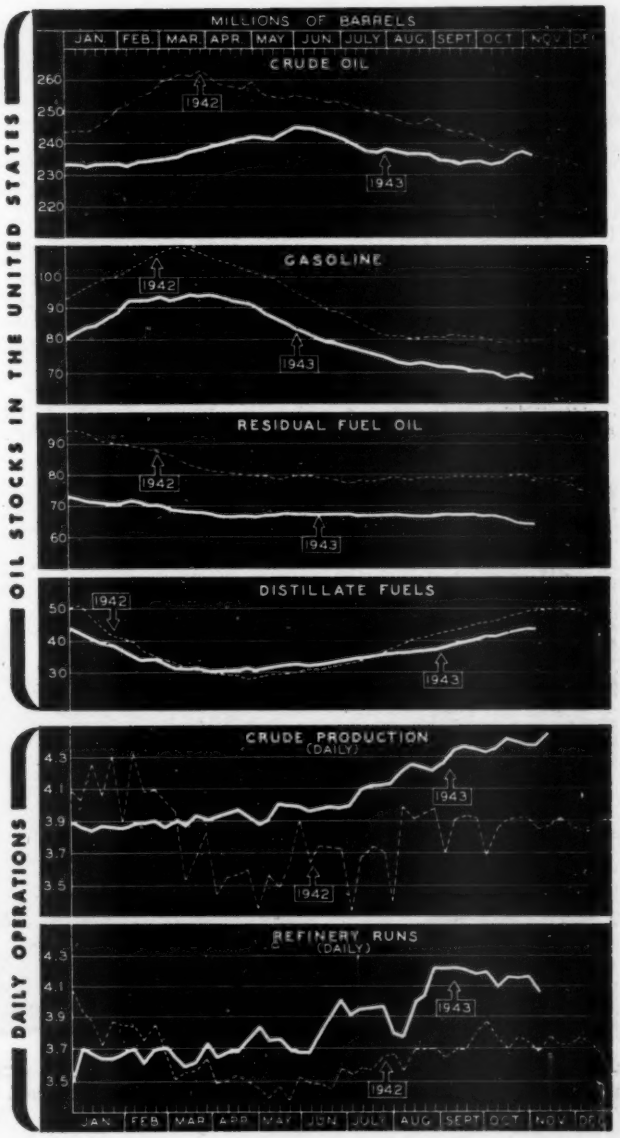
CRUDE-OIL PRODUCTION 4,449,410 bbl. daily average—up 70,285 bbl. One year ago 3,880,600.

REFINERY RUNS 4,079,000 bbl. daily week ended Nov. 6—down 97,000 bbl. One year ago 3,690,000.

OUT of the maze of information presented last week in official reports, addresses, and informal discussions at the Chicago meetings of the A.P.I. and the PIWC, oil operators are endeavoring to project their operations not only for the remainder of 1943 but also for part or all of 1944. Increased exploration and exploitation drilling has been approved by the war agencies for next year with indications that the program will be further liberalized during the year should the expected additional materials be made available. Opinions of operators as to just what will be done vary, with the necessity of better prices for crude oil and products emphasized by many as a required incentive for expansion in all types of drilling operations.

REPORTS the first of the week indicated that the conditions pointed to in economic reports at the Chicago meetings emphasizing the need for adjustments in transportation, are about to be remedied. It is understood that government agencies have agreed to the financing of crude-oil shipments from West Texas to several refineries in District 2. This has been under consideration for several weeks and in the plan which will be effective around December 1 the refinery buyers will be compensated for the tank-car transportation charges in the movement of the West Texas crude to District 2 plants. It is understood that the initial movement will be small but will be increased as more supplies become available. Preparations are also being completed to increase the shipments of West Texas and New Mexico crude oils to California. Additional loading facilities are being provided for this movement which is scheduled to represent a substantial volume of crude oil later this year and early in 1944. The heavy transportation charges involved in these shipments will be absorbed in government payments. There are other plans to secure the maximum tank-car movement of crude oil to refining centers. This is part of a program to assure the largest possible distribution of available domestic supplies coupled with increased imports from Latin-American countries.

IN refining, every effort is to be made to complete construction programs. Several large projects are to be completed over the next few weeks. In this planning the Chicago reports revealed that manpower and delays in the delivery of certain critical materials were the principal problems confronting builders and operators.



Government Negotiations to Buy Interest In Saudi Arabian Operations Suspended

by Henry D. Ralph

WASHINGTON, D. C.—The first attempt of the government-owned Petroleum Reserves Corp. to buy into the ownership of an American oil company operating abroad has met with apparent failure. It is known, however, that PRC officials are attempting to reach their objectives by other means.

Officials would not comment on reports, but it appears rather definite that negotiations to purchase a substantial share of the stock of the California Arabian Standard Oil Co. have been dropped, at least temporarily. The company is owned jointly by the Standard Oil Co. of California and Texas Co., and has an exclusive concession for petroleum development covering virtually all of Saudi Arabia. It is understood that the company will proceed with plans to construct a refinery and other development work in Saudi Arabia with its own funds but probably on a modified scale than that envisioned by the PRC.

It is understood, however, that PRC is conducting other negotiations with American oil companies in an attempt to work out a partnership arrangement for foreign operations in the Middle East and elsewhere. One objective is to follow the pattern of the British and Dutch Governments which have long held a financial interest in oil companies operating abroad. It is felt in PRC that in this way the U. S. Government will be in a position to assist American companies and protect the general public and military interest after the war by negotiating concessions and operating rights with smaller companies and in facing competition from foreign cartels.

Ickes Has Postwar Plan

Harold L. Ickes, who as Secretary of the Interior is president of PRC, is understood to have a postwar world-peace plan which involves control of the major portion of the globe's oil resources by nations which are now allied, contemplating some sort of international agreement on development and distribution so that potential aggressor nations will be unable to obtain oil reserves sufficient for war purposes. Whether or not this far-reaching idea is connected with current negotiations with American companies is not known, since the pressing problem at the moment is to develop foreign sources of oil for military operations to relieve the strain on U. S. reserves and facilities.

The Truman committee of the Senate is currently holding closed hearings on the Army's Canol project in northern Canada, and is expected to look into the entire world-oil situation at the same time. Although he had nothing to do with the Canol project, Secretary Ickes is expected to supply information to the Truman committee, which would indicate that the committee's study is of broad scope.

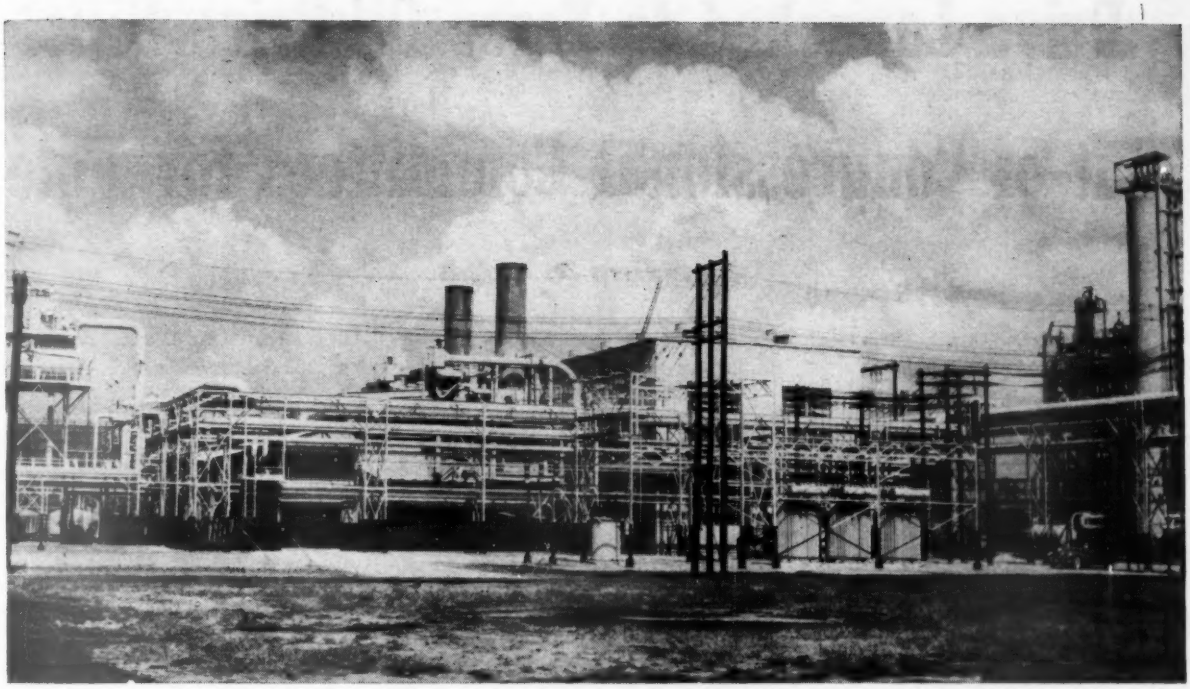
Specifically, it was reported this week that letters of intent had been withdrawn covering government commitments for refinery construction in the Middle East totaling $118,000,000 and blanketing a drilling and transportation program in the same area to the extent of $90,000,000.

Representatives of engineering and equipment companies who had participated in the preliminary planning for expansion of the Middle East refinery and production facilities advanced the logical explanation that cancellation of the two related programs was intimately related to general expectations on duration of the European phase of the war. Numerous authorities are confident that the European fighting will have been concluded before either the refinery or drilling programs first contemplated could be fulfilled to a helpful extent. Some observers reported that PRC, a subsidiary of the Reconstruction Finance Corp., was to have received a one-third interest in California Arabian Standard Oil Co. holdings in exchange for the financing of development to the extent of $208,000,000.

It was hinted in Washington this week that the Government, probably operating through PRC, has become interested in another development project in the Persian Gulf area. Speculation was that the negotiations now under way probably relate to development of additional production in Iran where Anglo-Iranian Oil Co.,

(Continued on page 28)

Will leave for Middle East soon on oil survey for Petroleum Reserve Corp.: John Murrell; W. E. Wrather, director of the U. S. Geological Survey; Abe Fortas, and E. DeGolyer, consultant to Petroleum Reserve Corp.



Magnolia Petroleum Co.'s new power plant at its Beaumont, Tex., refinery, one of the most modern facilities in the country

THIS WEEK

RATIONING—All 100-octane plants still under construction assigned top priority ratings to speed completion . . . ¶Performance of Cities Service's isomerization plant at East Chicago, on stream almost continuously since last May, confounds technicians . . . More details on isomerization may be revealed soon, if Army and Navy will ease censorship . . . ¶Middle West plant operators still seeking way to maintain maximum recovery of war products and, simultaneously, comply with latest PAW restrictions on civilian motor fuel . . .

FOREIGN—Negotiations broken off for government purchase of interest in Saudi Arabian properties. . . . Reports are that California Arabian Standard Oil Co. wouldn't accept Petroleum Reserve Corp. terms. . . . Letters of intent withdrawn on $118,000,000 refinery-expansion program and $90,000,000 outlay for new wells, all in Middle East. . . . ¶PRC reported negotiating for another interest in Persian Gulf area, possibly in Anglo-Iranian Oil Co., or Kuwait Oil Co. Ltd. . . . ¶Allies reported planning 6-in. gasoline line from Calcutta to Chungking, for the final smash on Japan. . . . ¶PAW spokesmen reveal plans to export equipment to drill and complete 800 foreign wells next year. . . .

DRILLING—Industry analyzing PAW's projected pattern of 24,000 completions next year. . . . Increases in California, moderate declines in eastern states and Rocky Mountains are major changes. . . . Total includes 5,000 exploratory and 19,000 development wells . . . Peak of 6,500 wells forecast for third quarter . . .

EQUIPMENT—Relief promised for acute shortages of tool joints, drilling bits, certain critical power units. . . . Outlook for steel assignments to industry cover program adequately but contingencies are numerous. . . . ¶Two bit manufacturers may be relieved of war contracts. . . . ¶One derrick manufacturer advised to clear all European shipments of observation towers within 60 days, told to cancel orders remaining on books thereafter. . . .

TRANSPORTATION—WEP organization filling 20-in. products line with water. . . . Testing leg from Gulf Coast to Norris City to start shortly. . . . Less than 50 miles of pipe remains to be laid to complete products system to East Coast. . . . ¶Crude-oil runs through 24-in. increased to 297,394 bbl. daily at Longview, Tex., intake station. . . . ¶Yale Pipe Line Co. to build new Elk Basin line. . . .

SUPPLIES—Rumors persist that PAW plans consolidation of supply and distribution, marketing and transportation divisions. . . . ¶Economists contend current civilian gasoline allowances can be maintained, if OPA carries through on promised tightening of supplementary rations.

Drive Launched to Force Oil-Price Bills Out of Congressional Committees for Vote

by Henry D. Ralph

WASHINGTON, D. C.—The oil industry and congressional delegations from petroleum-producing states this week redoubled their efforts to force the Disney and Thomas price bills from committees and thus gain action on the floor of both houses. More than 126 signatures had been affixed to a House petition to discharge the Disney bill from the rules committee. The petition, in order to gain recognition, will require 218 signatures, a majority of the House membership.

A coalition between representatives of the coal-producing states with the House oil contingent was in process of formation. Representative Calvin Johnson of Illinois is spearheading the drive to weld coal and petroleum support in the House. If the strategy is successful, the coal bloc will offer an amendment to the Disney bill, removing jurisdiction over coal prices from the Office of Price Administration and placing this authority in Secretary Ickes as administrator of solid fuels. The Disney bill would make a similar transfer of power over the regulation of petroleum prices.

Decision to seek relief through Congress from OPA's rejection of recommendations for higher petroleum prices was reached by the Petroleum Industry War Council at Chicago, Ill., last week. Some PIWC members did not favor appeal to Congress, fearing that legislation inimical to interests of the industry would result. However, the independent segment of the PIWC, headed by Charles F. Roeser, Fort Worth, Tex.; Jake Hamon, Dallas, Tex., Ralph Zook, Bradford, Pa., president of the Independent Petroleum Association, and J. C. Hunter, Abilene, Tex., president of the Mid-Continent Oil & Gas Association, prevailed in their arguments that all other possible avenues of relief had been blocked.

Strong forces in the industry, despairing of finding a satisfactory substitute for a general increase in crude-oil and product prices, are certain that Congress offers the only hope for relief. This summary brings the congressional strategy up to date and indicates the future actions upon which the industry is pinning its hopes for freeing it from the strangling influences of rising costs and pegged prices.

Pressure to obtain Senate action on the Thomas bill which would leave jurisdiction over petroleum prices in the hands of OPA but with specific restrictions has not yet become apparent. The bill would prohibit OPA from fixing prices below parity and in no event at levels less than an average of $1.52 for crude oil.

Momentum to the oil and coal move in Congress was supplied this week by the critical report of OPA submitted by the House committee created to check on the administrative performances of executive agencies. The report condemned the usurpation of power by executive agencies through "misinterpretation and abuse of powers" granted by Congress "and the assumption of powers not granted." While the critical report was aimed primarily at the assumption of judicial powers by OPA, the committee declared that "there are right and wrong ways to accomplish these purposes."

California Operators Authorized to Rework Wells in Same Zone

WASHINGTON, D. C.—Removal of restrictions on the reworking of oil wells in California, provided the reworking is done in the same pool (pay zone) in which the well is currently producing, was announced here last week by Deputy Administrator Ralph K. Davies.

Object of the action, which was taken by amending Supplementary Order 4 to Petroleum Administrative Order 11, is to obtain maximum return of oil with the steel available for oil production in California.

Other changes cover standards on lifting installations, lease shipping pumps and addition of new fields to the list qualifying for spacing exemption in SO4.

Panel Approves Uniform Wage for Rig Builders

KANSAS CITY, Mo. — A special War Labor Board panel sitting here November 12, recommended by a divided vote that a uniform pay scale be established for oil riggers in 27 states. The panel was charged with the task of determining whether uniformity was necessary, and if so what the scale should be. A. J. Hoover, Tulsa, and Frank Meier, Houston, Tex., represented the industry. Carl C. Mattern, Tyler, Tex., represented the Oil Workers International Union (CIO). R. E. James, Kansas City, represented the American Federation of Labor.

There are approximately 1,500 rig builders in the Mid-Continent field, it was testified. Pay scales in East Texas, North Louisiana, Arkansas and Mississippi are $20 a day for the rigger and $22 a day for the crew foreman.

Colombian Production At Highest Level Since All-Time Peak in 1942

NEW YORK.—Crude-oil production in Colombia, second most important South American oil-exporting country, rose to 1,742,186 bbl., a daily average of 58,073 bbl., in September. It was the highest total for the country since an all-time peak of 2,336,000 bbl. was produced in February 1942.

September production compared with a total of 1,672,560 bbl. and a daily average of 53,960 bbl. for August and with a total of 348,002 bbl. and a daily average of 11,600 for September 1942.

For the first 9 months of this year Colombian production was 7,931,160 bbl. against 10,018,000 bbl. a decline of 2,086,840.

Speakers and society officers attending the Austin conference included: G. B. Corless, Humble Oil & Refining Co., and past chairman of the A.I.M.E. petroleum division; J. M. Bugbee, Baroid Sales Division, Houston, Tex., chairman of the Gulf Coast section, A.I.M.E.; W. S. Morris, vice president of the East Texas Salt Water Disposal Co., Kilgore, Tex., a member of the A.I.M.E., petroleum division executive committee; C. A. Warner, Houston Oil Co. of Texas, and chairman of the A.I.M.E. petroleum division, and H. H. Power, past chairman of the petroleum division and head of the petroleum engineering department, University of Texas

Engineers Discuss Salt-Water Disposal

by E. H. Short, Jr.

AUSTIN, Tex.—Attention was focused on the problems involved in the handling and disposal of salt water at a joint session of the American Institute of Mining and Metallurgical Engineers held here November 12-13.

The symposium on underground water problems was organized jointly by the Gulf Coast, East Texas College Station and University of Texas sections of the A.I.M.E. in connection with the annual meeting of Texas Academy of Science.

Bacteria in Oil-Field Brines

Microorganisms in oil-field waters also came in for considerable discussion and papers on the subject were delivered by F. H. Allen and Eloise McCabe, of the University of Texas. Salt water in the East Texas field is heavily contaminated with sulfate-reducing bacteria, which is responsible for considerable difficulty in preparing the water for subsurface injection. It has been the more or less generally accepted theory that the bacteria get into the water through the exposure of subsurface equipment to the air during servicing operations. Tests made by the authors under sterile conditions at well head and also from samples taken down hole indicate the possibility that these microflora are present in waters in the formations themselves. W. S. Morris, vice president and general manager of East Texas Salt Water Disposal Co., stated that the use of cholorine or heat in excess of 170° F. was satisfactorily effective in killing the bacteria in water in preparation for injection.

Salt-Water Injection

The work of East Texas Salt Water Disposal Co., composed of more than 250 major and independent operators, was discussed by Mr. Morris. Tne methods and procedures applied by this company, which was first in the field, are now being adopted in Magnolia and several other Arkansas fields; Conroe, Texas, and in one California field. The study of the salt-water-injection problem has been greatly facilitated, he pointed out, by means of scholarship funds, University of Texas petroleum engineering research work, and by Humble Oil & Refining Co. research.

Dr. F. B. Plummer, geologist in the Bureau of Economic Geology, University of Texas, stressed the importance of water purification before it is returned to the ground, and gave his view, contrary to Allen and McCabe, that bacteria contamination occurs after the water has been brought to the surface and exposed to the atmosphere. Exposure also accounts for a chemical change in the minerals contained in the water and this plus the microorganism present produces a plugging effect within the formation when the water is returned.

There was considerable discussion regarding the closed-system method of handling and disposing of oil-field brines. The closed system, it was brought out, minimizes the clogging of the oil sands, since there is no appreciable precipitation of insoluble iron compounds in the water, ordinarily caused by the open systems, The closed-system problems, it was pointed out, arise when treatment of salt water from diversely-owned wells is involved. Under these conditions it is necessary for the operator to provide means of accurately measuring the amount of salt water from each well before injection is made. One of the primary advantages of the closed system is the fact that corrosion of handling equipment is greatly reduced over that experienced with the open systems.

Need for More Hydrology

Paul Weaver, Gulf Oil Corp., spoke on the problems involved in obtaining water for farms, wells for suburban dwellers and for small industrial development. He pointed out that if some system was adopted by the oil companies to assure the accurate logging of the shallow seismograph shot holes drilled all over Texas, it would be a long step toward providing a map of the state's greatest natural resource—fresh water.

(Continued on page 28)

Operators Display Ingenuity in Preparing Location for Test in Gulf of St. Lawrence

by J. P. O'Donnell

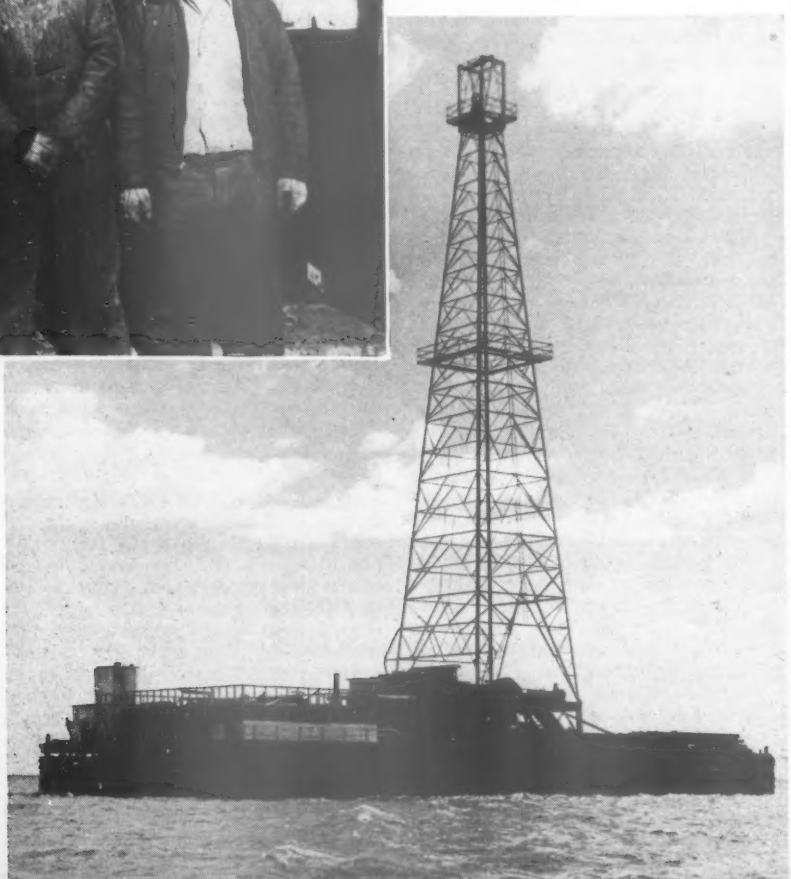
NEW YORK.—One of the most interesting of the many wildcat operations being conducted in the widespread search for new oil reserves is a well being drilled off Prince Edward Island, Canada, in the Gulf of St. Lawrence. The location is on a man-made, 9,000-sq. ft. island in the open water of Hillsborough Bay, 8 miles south of the city of Charlottetown, capital of the Province of Prince Edward Island. It is a joint venture in which Cities Service Co. and Socony-Vacuum Oil Co., Inc., are participating on an equal basis.

The location was selected after geophysical exploration indicated an anticlinal crest at that point and, despite the difficulties involved, drilling has been started.

Construction of the drilling island was accomplished by building cribbing at Charlottetown, floating it to the site and filling it with rock and concrete. The cribbing was built in sections which were later joined at the site.

The foundation was filled with 5,100 cu. yd. of rock and 500 cu. yd. of concrete. Approximately 7,700 tons of rock constituted the fill. Concrete columns on which the derrick rests reach to solid bedrock, cores of which were taken to determine its ability to support the rig.

The sea-going drilling crew, left, is composed of: Back row: Wilfred Montgrain, roughneck; J. C. Roberts, derrickman; E. R. Taylor, motorman, and I. E. Thorgood, motorman; front row: Neal Martin, driller; Emil Gallant, roughneck, and John Rundle, drilling superintendent. Below: The derrick and other equipment resting on the cribs



The deck area measures 75 by 120 ft. and is occupied fully by the derrick, drilling engines, slush pumps, mud pit, fuel tanks, pipe rack, etc. All the equipment was delivered to the foundation by barge. During the summer months personnel reaches the site by motor launch while in the winter a motor driven ice sled will be used. Communication with Charlottetown is maintained with a 8-mile telephone cable laid on the bottom of the bay. Fresh water is obtained from Governor Island, about 1.4 miles to the northeast, through a small diameter line which is also laid on the bottom of the bay.

The rig is the heaviest and most modern available to suit conditions existing in the bay. The 146-ft. derrick has a lifting capacity of 800,000 lb. with a safety factor of 2. It is constructed of special silicon steel and weighs 38 tons. Two 350-hp., 8-cylinder diesel engines which drive to a common shaft carrying direct current generators furnish the power for drilling. The slush pumps, with a capacity of 800 g.p.m., the draw-works and rotary table are driven by D. C. motors through the necessary control gear. Auxiliary power, principally for general purpose pumping and heating, is supplied by a 100-hp. diesel engine and a 40-hp. vertical, oil-fired steam boiler.

Equipment on hand includes 14,000 ft. of 4½-in. drill pipe, 1,500 ft. of 13½-in. casing and 9,000 ft. of 9⅝-in. casing. The well, which was spudded October 12, was reported drilling at a depth of more than 1,000 ft. last week. The immediate objective is to run the 9⅝-in. string before extremely cold weather sets in so that no major casing work will have to be undertaken under unfavorable conditions. The operations are under the supervision of the Island Development Co., Socony-Vacuum subsidiary.

The nearest oil production is the small Stony Creek field at Moncton in New Brunswick, 100 miles to the

west. Production of the Stony Creek field is only about 75 bbl. daily. However, the 1 Hillsborough is not the first well drilled in this immediate area. In 1928 Cities Service drilled a deep test to 5,970 ft. on Governor Island, 7,250 ft. northeast of the Hillsborough location. In spite of this failure, Cities Service, through a subsidiary, acquired the oil rights to the whole of Prince Edward Island, an area of about 2,184 square miles. In 1942 Socony-Vacuum was invited to join in the investigations which Cities-Service had been conducting and later decided to participate.

George Granger Brown Elected President of Chemical Engineers

PITTSBURGH, Pa.—George Granger Brown, professor of chemical engineering and chairman of the department of chemical and metallurgical engineering of the University of Michigan, Ann Arbor, has been elected president of the American Institute of Chemical Engineers for the year 1944, it was announced here last week at the thirty-sixth annual meeting of the institute. Professor Brown succeeds J. L. Bennett, manager, chemical operations, explosives department, Hercules Powder Co., Wilmington, Del. Dr. L. W. Bass, director of the New England Industrial Research Foundation, Boston, Mass., was elected vice president.

G. G. BROWN

Professor Brown is well known in petroleum and chemical circles as a consultant and author and in 1939 he won the Walker Award, given by the American Institute of Chemical Engineers for the most outstanding paper of chemical engineering interest published in the institute transactions for the preceding 3 years. In 1940 he was given the Hanlon Award of the Natural Gasoline Association. He is consulting engineer for the Michigan Geological Survey, Natural Gasoline Association of America and the American Petroleum Institute. He is the author of "Clays and Shales of Michigan" and "Michigan Molding Sands" and numerous technical articles.

Doctor Bass was formerly an assistant director of Mellon Institute and director of research of the Borden Co. He is a technical aide, office of the chairman, National Defense Research Council; chairman of the committee on quartermaster problems of the National Research Council, and on the advisory board of the research and development branch, Office of the Quartermaster General.

A new distillation column was described at the meeting by E. H. Smoker of Philadelphia, Pa. The new invention was developed by engineers of the United Gas Improvement Co. as an aid to the high-temperature oil-cracking process. Because in conventional distillation equipment, compounds combine with themselves to form complex molecules, or in the words of the author, "unsaturated hydrocarbons polymerized," it was necessary to develop a new batch distillation still having high efficiencies.

The new distillation column consists of five identical 30-in. diameter sections, each containing seven 8-in. steel tubes. The hot vapors from the heated oil mixtures rise through the open spaces between sections, while the condensed vapors are collected at the bottom of the individual tubes.

As part of the development, the engineers of U.G.I. devised a unique control for the new column. By use of an instrument which measures the pressure drop of the hot vapors ascending the column, the flow of steam heat is regulated and efficiency maintained.

Some of the labor that goes into the development of modern chemical wonders was revealed when H. J. Nebeck of Universal Oil Products Co., Chicago, told for the first time the history of the development of hydrogen fluoride alkylation, a process now making a petroleum blend which is a major ingredient in high-octane gasoline.

The chemical process itself consists in reacting two petroleum compounds to form another highly branched compound of high antiknock properties. At present, the reaction is between isobutane and either propylene, butylene, or amylene. The pilot-plant investigation of the process which has consisted of more than 300 test runs on five different pilot plants, has been under way for several years. Because of the war, it was necessary to begin the design and construction of commercial units before a comprehensive pilot-plant program could be completed.

One of the interesting problems that had to be solved was that of a suitable seal and packing for the steel shafts of the stirring mechanism. Because of the corrosive nature of the acid, the packing was eaten away quickly. This difficulty was overcome by introducing all the petroleum gases which were to be reacted into the space around the shaft and just below the packing where it served as a protective flush. Three other major problems in connection with plants and which had to be solved at the small pilot plant dealt with the recovery of the dissolved acid in the alkylation products, the defluorination of the alkylation products and the regeneration of the used acid. "The importance of recovering the hydrogen fluoride," said the authors, "is shown by the fact that the value of the dissolved acid amounted to 3 cents a gallon of alkylate." The recovery was accomplished through a stripping operation.

The second problem of removing the fluorinated products from the aviation fuel was solved by passing the alkylate through bauxite, the same material from which aluminum is made, and the first plants constructed are using this system. Further research has now revealed a secret catalyst which reverts the fluorinated hydrocarbon back to its original components of acid and olefin, the petroleum gas.

The regeneration of the hydrogen fluoride, the third major problem, proved to be the easiest and is now being done by simple distillation.

Carter Buys Minnelusa and Plans Active Development

Carter Oil Co., Tulsa, has purchased the stock of Minnelusa Oil Corp., Denver, Colo., and plans active development of acreage acquired.

Minnelusa holdings include properties in the Lance Creek field of Niobrara County, Wyoming, with a daily average net production of 1,300 bbl., and producing properties in the new Elk Basin pool of Park County, Wyoming, and Carbon County, Montana, which have a net daily output of 2,000 bbl., according to O. C. Schoep, president of Carter. Among other holdings are some 3,400 acres of undeveloped leases in the Elk Basin area.

Carter has been pursuing an active exploration program in the northwest territory and at present maintains exploration headquarters at Billings, Mont. A subsidiary, Santa Rita Oil & Gas Co., operates 2,000 bbl. a day production in the Cut Bank field of northwestern Montana.

The president of Minnelusa, Richard S. Shannon, is chairman of District 4 production committee and a member of the Petroleum Industry War Council. He will continue development of other oil properties in the Rocky Mountain area.

Hildreth Field's Performance Raises Appraisals on Caddo Conglomerate Pay

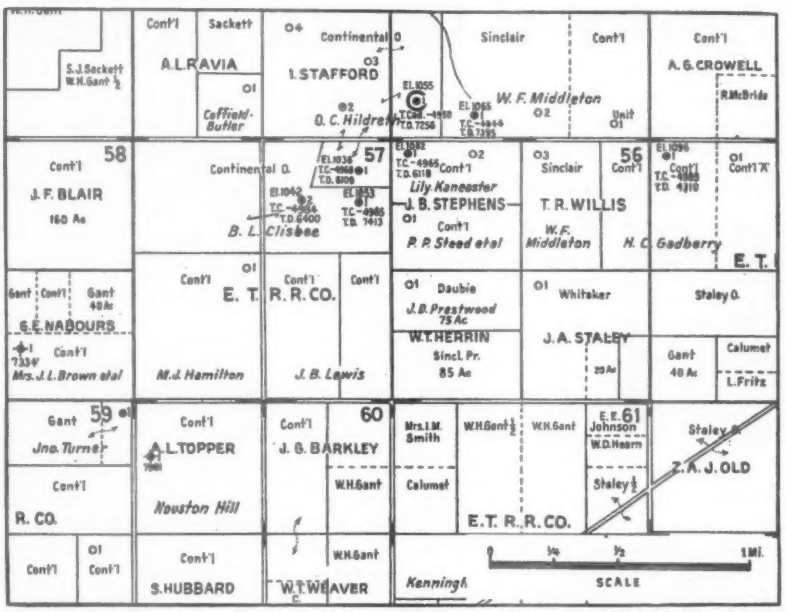
by Harry F. Simons

WICHITA FALLS, Tex.—The Caddo (Bend) conglomerate has attracted operators in the North Central Texas area for the past several years and hopes for major pools in this formation have recently risen sharply owing to the discovery and development to date of the Hildreth pool in Montague County, Texas. Currently, Hildreth is the area's outstanding discovery of 1943 and it is the center of the greatest concentration of drilling activity in the region. The field also has deeper production as the discovery well was completed in the Ellenburger (Ordovician) lime.

While the Hildreth pool produces from the conglomerate, many of the Bend (Pennsylvanian) pools in North Central Texas find production in the Bend lime. The conglomerate pools are generally much more prolific. Pools producing from the Bend formation previous to 1943 totaled 23 and practically all were discovered in the last 5 years. So far this year there have been 12 new Bend pools discovered but Hildreth is outstanding when its potential area and productiveness of the wells are considered.

Prospecting in the Hildreth pool started with the view to exploiting the deeper pays. The first well there, Continental Oil Co. 1 A. C. Hildreth, 856 ft. from the south and 509 ft. from the west lines of Section 53, E.T.R.R. Survey, A-250, was completed originally in October 1942, in the Ellenburger pay at 7,170 to 7,201 ft. Initial production was 329.4 bbl. per day. Only recently this well was dually completed by perforating the casing opposite the Caddo conglomerate. (A Journalog on Continental's discovery well was published in the Journal July 1).

During the drilling of the discovery well, drill-stem tests run in the Bend conglomerate showed some free oil, a strong bottom-hole pressure and no water. Consequently when the Continental 1 Jack Hildreth "A" 660 ft. from the north and east lines of Section 57, E.T.R.R. Survey, was drilled, it was decided to test these upper formations and investigate their potentialities. After running drill-stem tests at 5,990-96 ft. and at 6,065 to 6,109 ft. casing was run to the top of the pay and the well washed in. It flowed 1,136 bbl. in 6 hours through a 1-in. choke on 2-in. tubing for a potential of 4,515 bbl. per day. Gravity of the oil was 40.6° A.P.I. The well was completed last February.



Hedrick Mapping Co.

Map of Hildreth field and vicinity, showing location of producing and drilling wells and the elevation, top of the Caddo formation and the total depth of producing wells

Subsequent drilling and the completion of five wells as conglomerate producers has not resulted in another Ellenburger well but has clarified the situation as far as the conglomerate is concerned. One of the latest completions, Continental 2 Clisbee, 1,325 ft. from the north and east lines of Section 57, E.T.R.R. Survey, A-252, showed that there were four pay zones there in the conglomerate. This well is the third one in the pool in which there was no attempt to test the Ellenburger.

Total depth of Continental 2 Clisbee was 6,400 ft. and 7-in. casing was run to 6,399 ft. The respective zones were then tested by perforating the casing, beginning opposite the lowest horizon. After testing each zone, it was plugged off and the next higher one tested. The number of shots, and the production of each zone are shown in the following table:

CONTINENTAL 2 CLISBEE

Pay zone: Caddo (Bend conglomerate) (ft.)	Perforations (No.)	I.P. (bbl./day)	Choke (in.)
6,265-70	12	1,131	1/2
6,245-53	20	1,675	1
6,216-27	24	1,424	3/8
6,098-6,103	15	1,289	1/4

Elevation of the well is 1,042 ft.

Completions in the Bend conglomerate have averaged 2,143.8 bbl. per day but most have been choked back to some extent although the choke orifices are large, the smallest being 15/64-in. The gas-oil ratio is low being around 800 cu. ft. per barrel; it varies from around 600 cu. ft. per barrel to as much as 1,500 cu. ft.

Average depth to the top of the Caddo is —4,969 ft. (subsea) and from

(Continued on page 28)

> Historical prolific production from Bend conglomerate is the chief magnet attracting the greatest concentration of drilling in the North Central Texas area to this outstanding discovery of the year.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

The Administrator Hedges

THE Government's foreign policy in regard to war and postwar oil was a mystery before the reading of Petroleum Administrator Ickes' A.P.I. address began and it continued to be when the reading was completed.

After indicating that the Petroleum Reserves Corporation, created several months ago to engage in oil operations outside this country, was just another war agency, Mr. Ickes became involved in an explanation of foreign oil plans which point to a permanent governmental department in the making. The explanation will not allay but rather will add to the concern of those who fear that petroleum will be used as an excuse for entangling alliances between the oil industry and Government and between governments.

Had the administrator stated that our Government was simply using PRC as another agency in making oil supplies available to the Allies during the war in the same manner that other emergency units function in domestic operations and that it would end with the peace, the Chicago explanation could have been ended quickly. But he was careful not to say that.

Instead, Mr. Ickes said that the administration's program was tied into the question of whether or not we shall have enough oil to win the next war.

The fear of an oil shortage is a typical bureaucratic viewpoint that always assumes that progress has ended, which, in this instance, means that the domestic oil industry has passed its peak and has started on a permanent decline.

The head of PRC also pointed out that "the United States is one of the few major countries which has not participated in foreign oil activities through governmental financing or direction."

What of it? Could there be better evidence that the oil business in this country should continue as a private enterprise than the record of government-dominated operations elsewhere? More than 65 per cent of the world oil supplies are now located here. Our nationals have another 10 to 15 per cent elsewhere. Add to this the part that our materials, operating practices and trained personnel play in oil operations everywhere and the oil business is largely an American enterprise.

This is no criticism of other nations who feel that their own economies are best served in government-controlled oil operations, but there is nothing in the record to indicate that this country should do likewise.

In his annual address to the industry the administrator justified government assistance and "participation" to the "extent that private capital and private initiative are unable to establish and maintain a national position in this field." This industry would be interested in any information that the war agencies have that oil companies will not be able in the future, as they have in the past, to conduct foreign activities without governmental aids. It is assumed, of course, that future administrations will support their nationals operating privately outside this country, under principles established in international agreements.

The question has been asked: Why worry what our Government does in regard to a few companies operating outside this country? Aside from the change in foreign policy, which concerns every American, the answer is that if Government participation in foreign oil operations is upheld it can also be justified at home. In fact, the two programs are inseparable.

Industry's Accomplishments on Ascendency, Discussions at A.P.I. Meeting Reveal

by H. Stanley Norman

CHICAGO. — The year's analysis of oil-industry affairs, the underlying purpose of the annual American Petroleum Institute meeting which ended here last week, showed a strong balance in favor of war accomplishments. Outstanding in the industry's 1943 failures has been its inability to prove its case for higher prices in top administration offices where rests the power of decision.

The price question was not particularly emphasized in most addresses before the A.P.I., but it held center stage well forward in the 2-day meeting of the Petroleum Industry War Council which was held simultaneously. Most PIWC members are active leaders in the A.P.I., as well as in other trade associations, and it is impossible to draw a sharp line of demarcation between any two groups with such a high percentage of overlapping membership.

The unreserved, informal endorsement by A.P.I. delegates of the PIWC resolution calling on Congress to gain the price relief which has been denied by executive agencies of the Government, left little doubt about the topic of chief interest. Unvarnished disappointment was registered by most A.P.I. delegates over inability of Petroleum Administrator Ickes to make a personal appearance at the Chicago meeting. The disappointment was all the more bitter because it was the second time in the 2-year war history of the A.P.I. that circumstances forced deliverance of his paper by a last-minute substitution.

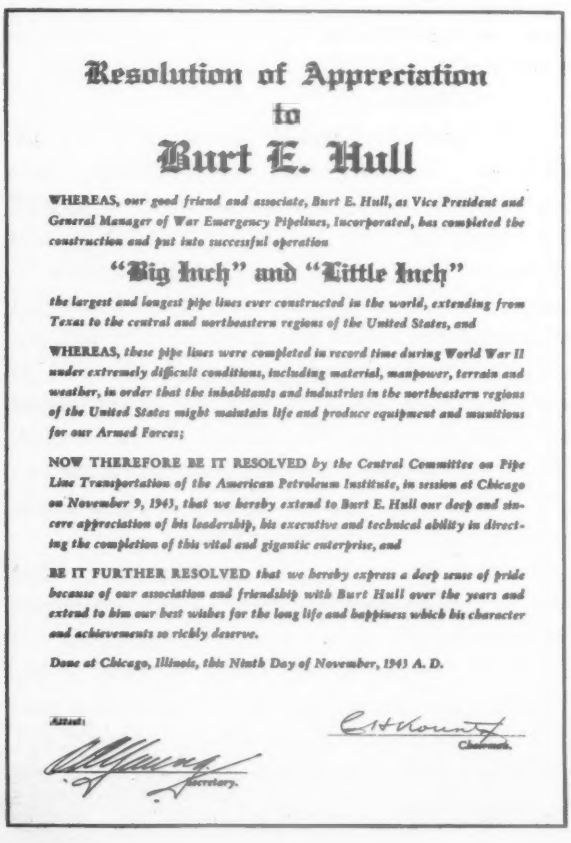
A capacity crowd in the Palmer House ballroom, however, paid close attention to the address prepared by Mr. Ickes and delivered by George A. Hill, Jr., president of Houston Oil Co. of Texas. The administrator lashed out sharply at critics who he said are "whispering" that the Petroleum Administration for War functions in sympathy with the major companies to the detriment of independents. His vitriolic invectives also were hurled at critics of the PAW Directive 70 which covers exchanges, transportation and other elements in distribution of foreign petroleum supplies owned by American companies.

Oil men were heartened, however, by the administrator's declaration that he was unwilling to allow the question of proper incentives for oil exploration to go unanswered. By inference, at least, Secretary Ickes told oil men that he would appeal the adverse decision of Fred M. Vinson, director of the Office of Economic Stabilization, unless PAW and the industry could invent a satisfactory substitute. Absent, however, was the administrator's previously outspoken rejection of subsidies, although neither did he commend this alternative which has been strangled by spontaneous objection within the industry.

Forecast of Operations

Predictions that production and refining capacities will be taxed to meet the war demands next year, that the materials position will improve and that the manpower shortage will grow more acute were made by Ralph K. Davies, deputy petroleum administrator. He made these 10 observations on future outlook:

1. We face a definite shortage of crude oil in this country in the coming year.
2. The manpower situation in general will become progressively worse.
3. The materials position will improve somewhat with sufficient materials for essential operations, some relaxing in the matter of well spacing but no prospect of unrestricted activity.
4. The domestic transportation problem is pretty well solved.
5. Refining capacities will be taxed to their efficient limits.
6. Refining operations will have to be conducted under the additional handicap of unavailability of the desired qualities in crudes.
7. The quality of finished products will have to be debased.
8. The gasoline supply for motorists in 1944 cannot be greater and may well be less.
9. The full war order for oil, plus the industrial and curtailed civilian demand, can only be met through greater reliance upon foreign resources.
10. The current rate of new tanker construction assures improved trans-



Resolution of Appreciation
to
Burt E. Hull

WHEREAS, *our good friend and associate, Burt E. Hull, as Vice President and General Manager of War Emergency Pipelines, Incorporated, has completed the construction and put into successful operation*

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the largest and longest pipe lines ever constructed in the world, extending from Texas to the central and northeastern regions of the United States, and

WHEREAS, *these pipe lines were completed in record time during World War II under extremely difficult conditions, including material, manpower, terrain and weather, in order that the inhabitants and industries in the northeastern regions of the United States might maintain life and produce equipment and munitions for our Armed Forces;*

NOW THEREFORE BE IT RESOLVED *by the Central Committee on Pipe Line Transportation of the American Petroleum Institute, in session at Chicago on November 9, 1943, that we hereby extend to Burt E. Hull our deep and sincere appreciation of his leadership, his executive and technical ability in directing the completion of this vital and gigantic enterprise, and*

BE IT FURTHER RESOLVED *that we hereby express a deep sense of pride because of our association and friendship with Burt Hull over the years and extend to him our best wishes for the long life and happiness which his character and achievements so richly deserve.*

Done at Chicago, Illinois, this Ninth Day of November, 1943 A. D.

Attest: Secretary. Chairman.

This is a facsimile of the citation presented to Burt E. Hull, vice president and general manager of the War Emergency Pipelines, Inc., by the A.P.I. production division at the annual meeting in appreciation for his work in completing the two major emergency projects

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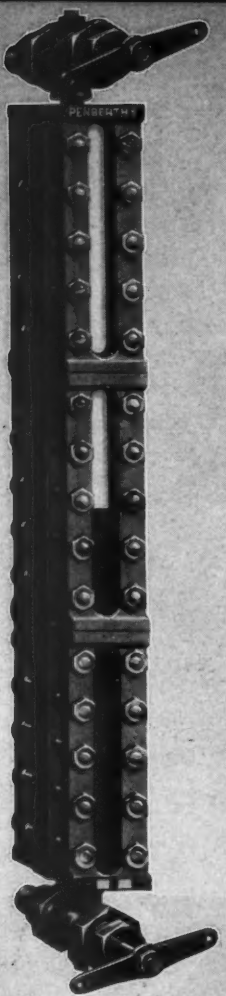

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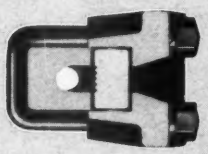

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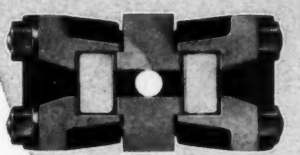

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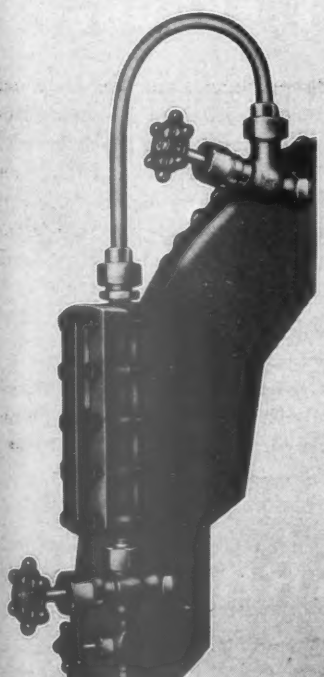

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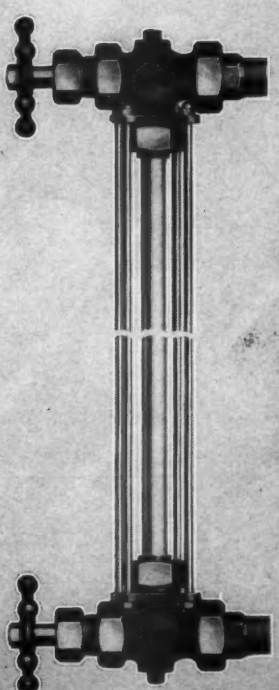

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portation capacity and greater flexibility.

Importance of aviation gasoline was stressed by Ralph A. Bard, assistant secretary of the Navy, who addressed the final general session of the A.P.I.

If petroleum consumption of the Army and Navy were stated in terms of dollars, including lend-lease and War Shipping Administration operations, he said, 44.7 cents of each dollar would go for aviation gasoline; 18.1 cents for motor gasoline, 18.4 cents for fuel oils, 5.9 cents for diesel oil and kerosene and the remaining 12.8 cents for lubricants.

Administrator Ickes chided the independent element which he accused of attempting to undermine his conduct of petroleum affairs and suggested that their criticism, if justified, would be more effective if lodged through PAW committees, the PIWC, or direct to his office, rather than around Capitol Hill.

Ickes Assails Critics

"It is brought to my attention every now and then that someone has been burping that PAW is dominated by the majors, or that PAW lacks sympathy for the independents.

"Now, if anything were needed to make this kind of thing more stupid than it is naturally, it is the fact that, all of my life, I have been motivated by the fervent desire to protect the rights of the independent businessman. Indeed, I have been so active and outspoken in that regard that I have on occasion been accused of being anti-big business. Well, it so happens that I am not a foe of big business, so long as it is honest and so long as it is not monopolistic. However, I never expected to live to see the day when I would be branded as 'anti-little business.' My reaction when I first began hearing of this rumor-mongering was to ignore it as unworthy of attention, but it is apparent that a systematic campaign is under way, and so I choose to bring it out into the open.

"Yes, we have men from major oil companies on our staff. Mr. Davies is from a major oil company. Some of the division directors are from major oil companies. And I have no hesitancy in telling you that I have been very happy to have them. Far from attempting to use their positions to trample upon the independents, they have—judging from the evidence that I have seen—been scrupulous in leaning in just the opposite direction.

"As to our industry committees, I have said that our aim has been to strike a balance as between independents and majors. Certainly, regardless of whatever dispute there may be as to whether this or that committee member is or is not a bona fide independent, I do not know of any committee which does not have independent representation. So, if the independents on any committee should at any time decide that the cards are stacked against them, I would think that they would so report to us, either directly, or through the Petroleum Industry War Council. After all, one of the principal purposes in creating the committees and the war council was to give every element of the industry a voice. There are two ways in which that voice can be used: It can be used with the desired loudness in the committees, in the war council, and to me, or it can be used in a whisper on Capitol Hill in an attempt to stir up political fires. Frankly, I would suggest that one of the first methods would be more productive, especially if there be a just grievance.

"All of the developments of the last year have not been pleasant ones, and in saying this, I am thinking of the shortage of crude oil. It is purely academic to say that this shortage could have been prevented or alleviated if a higher price ceiling had been permitted. We have to face the fact that a higher price was not permitted. PAW thought that a price increase should be granted. We said that we believed that it would stimulate exploration, that it would make possible more extensive employment of secondary-recovery methods, and that it would enable many marginal locations to be drilled and more stripper wells to continue their operations. That is why we recommended a price increase to OPA. That is why we asked OPA to reconsider our recommendation after we were turned down the first time. And that is why, after the second turndown, we appealed to the director of economic stabilization.

Vinson Verdict Disappointing

"His verdict was no less disappointing to us than it was to you, but it is, nevertheless, the verdict.

"Whatever may be the final means of stimulating the discovery, development and production of additional crude-oil reserves, Judge Vinson has now advised the petroleum administration and the industry, through the Petroleum Industry War Council, to attempt to devise some plan, short of a general price increase, which will provide additional financial incentives for the achievement of these ends.

"Obviously, an attempt to invent some such plan or program is the next step. However, thus far we have been unable to formulate such a plan. But, in view of Judge Vinson's request that we discover some new formula short of a general price increase, I have asked my staff, and I now urge the industry, to undertake immediately to try to formulate some program or policy, other than a general price increase—one which we can conscientiously recommend to Judge Vinson as practical, workable and administratively feasible.

"Above all, I am willing, in view of our need of additional reserves, to allow this question of proper financial incentives for producers to remain unsolved. Therefore, it is necessary that we proceed in good faith and with all possible speed. This, as I have said, is the next step. Only after we have attempted to devise such a program as has been requested can we in PAW determine what the steps thereafter shall be.

"This leads inevitably to the question of foreign oil—a question which has stimulated such heated controversy that I consider it essential that I discuss it as fully as may be, and make my position clear.

"With respect to the Petroleum Reserves Corp., there seems to have been a great deal of misguided and inaccurate speculation as to its purposes and future course of conduct. Actually, there is no occasion for the type of rumors which have come to my ears. Petroleum Reserves Corp. is in no sense the first, although so far as I know it was the latest of the governmental corporations which the war has compelled us to create to meet our national needs for critical materials.

Assured Supply Sought

"In order to protect business here in the United States, to assure the American people of enough oil to meet their needs, and to make certain that there is sufficient oil for military requirements, it is necessary that the United States obtain a fair measure of access to foreign-oil resources. We will be able to make available within our present reserves enough oil to finish this global war, but we couldn't possibly oil another war of this size. In view of this fact we would be remiss in our duty and indifferent about the future of our country if we did not adopt measures to assure ourselves of enough oil in the event of another world war. We hope that there will not be such a war, but we would do well to remember the old adage: 'Soft words butter no parsnips.'

"At the present time, there is no international arrangement which adequately carries out the principles of the Atlantic Charter so as to guarantee to the nations of the world fair access to the world's oil resources. It is hoped that some such agreement will be forthcoming. A program of this sort would contribute greatly to the peace and security of all nations.

"In the past, a number of United States oil companies have established themselves in the foreign oil business. They have obtained rights to oil reserves, they have constructed facilities to process and transport oil, and they have engaged in world-wide distribution of oil and its products. This has been done entirely as a result of private initiative with the Government extending its good offices. On the other hand, the other principal

nations of the world—or most of them —have conducted their foreign oil business through corporations or agencies which are entirely or partly owned or in effect controlled by the government itself. The United States is one of the few major countries which has not participated in foreign-oil activities through governmental financing or direction.

"To the extent that private capital and private initiative are unable to establish and maintain a national position in this field, government assistance and participation may be necessary. The Petroleum Reserves Corp. is available for these purposes whenever and wherever necessary.

"With respect to another phase of foreign oil, there has also been some indiscriminate shooting. It has been aimed at our Directive 70, which was issued to make possible the same kind of joint use of facilities and products in foreign operations as we have employed to meet war-created shortages of supplies and facilities at home.

"The allegation is that Directive 70 constitutes a 'cartel' — oh, even worse than that, a cartel cooked up by the Government itself.

"It calls for a pooling of products and facilities, at the direction of the Petroleum Administrator for War, for the duration of the war. It has nothing to do with prices, it does not limit spheres of operation, and since it is a governmental design in order to facilitate the distribution of supplies to the armed forces, not only with the knowledge and consent of the Government but at its direction, it cannot by the widest stretch of the imagination, be called a cartel.

"I think that the subject of private enterprise might be a good one on which to conclude my remarks. From the very beginning, I have said that it would be my policy to rely as fully as possible upon free enterprise to get the wartime oil job done; that it would be my objective to hold government direction and control to the minimum consistent with wartime requirements. It is my firm conviction that it is because of this policy that the petroleum industry has done so excellent a job so far in this war."

All A.P.I. Officers Reelected

CHICAGO. — All officers of the American Petroleum Institute were reelected for another term at the annual meeting here last week. The Institute voted to hold its next annual meeting in Chicago with the date and convention headquarters to be selected later. Reelected officers are:

W. R. Boyd, Jr., president; George A. Hill, Jr., vice president for production, Houston Oil Co. of Texas, Houston; vice president for refining, J. Howard Pew, Sun Oil Co., Philadelphia; vice president for marketing, E. V. Weber, Eureka Oil Co., Cincinnati; treasurer, O. D. Donnell, Ohio Oil Co., Findlay, Ohio, and secretary and assistant treasurer, Lacey Walker, American Petroleum Institute, New York.

The board also elected the members of the Institute's executive committee for 1944, as follows: J. A. Brown, Socony-Vacuum Oil Co., New York; R. H. Colley, Atlantic Refining Co., Philadelphia, Pa.; H. D. Collier, Standard Oil Co. of California, San Francisco, Calif.; Henry M. Dawes, Pure Oil Co., Chicago; Ralph W. Gallagher, Standard Oil Co. (New Jersey), New York; Jake L. Hamon, Cox & Hamon, Dallas, Tex.; William F. Humphrey, Tide Water Associated Oil Co., San Francisco, Calif.; J. C. Hunter, Mid-Continent Oil and Gas Association, Abilene, Tex.; W. A. Jones, Cities Service Co., Los Angeles, Calif.; F. A. Leovy, Gulf Oil Corp., Pittsburgh, Pa.; B. L. Majewski, Deep Rock Oil Corp., Chicago; Frank Phillips, Phillips Petroleum Co., Bartlesville, Okla.; Charles F. Roeser, Roeser & Pendleton, Inc., Fort Worth, Tex.; W. S. S. Rodgers, Texas Co., New York; E. G. Seubert, Standard Oil Co. (Indiana), Chicago; H. F. Sinclair, Sinclair Oil Corp., New York; W. G. Skelly, Skelly Oil Co., Tulsa, Okla.; Reese H. Taylor, Union Oil Co. of California, Los Angeles, Calif., and R. G. A. van der Woude, Shell-Union Oil Corp., New York.

The members of the American Petroleum Industries Committee also were reelected as follows: Harry T. Klein (chairman), Texas Co., New York; Edwin S. Hall (secretary), Standard Oil Co. of New Jersey, New York; James J. Cosgrove, Continental Oil Co., Ponca City, Okla.; Cyrus S. Gentry, Shell Oil Co., Inc., New York; L. A. Gibbons, Union Oil Co. of California, Los Angeles; George V. Holton, Socony-Vacuum Oil Co., New York; Buell F. Jones, Standard Oil Co. (Indiana), Chicago, and William A. McAfee, Standard Oil Co. (Ohio), Cleveland, Ohio.

25-Year Club Elects Otto Donnell President

CHICAGO, Ill.—The 25-Year Club of the petroleum industry held its fifth annual banquet at the Chicago Club November 9. Otto D. Donnell, president of The Ohio Oil Co. succeeded Frank Phillips as president.

The annual meeting of the 25-Year Club is held each year during the week of the American Petroleum Institute annual meeting. The club is limited to 300 members, each of whom must have been actively engaged in the oil industry for at least 25 years.

Spang Heads Supply Men's Association

CHICAGO.—New officers and two new directors were elected here last week by the Petroleum Equipment Suppliers Association which held its annual meeting in conjunction with the A.P.I. convention.

Ferd J. Spang, Spang & Co., Butler, Pa., was elected president, succeeding Fred F. Murray, Oil Well Supply Co., Dallas, Tex. Hugh H. Glen, Emsco Derrick & Equipment Co., Los Angeles, Calif., was elected vice president, and Wharton Weems, Houston, Tex., was reelected executive secretary and general counsel.

The two new directors were elected, increasing the board to 48 members. Additions are: Jack Pike, president of Republic Supply Co. of California, Los Angeles, and Warner Parker, manager of sales for Oil Well Supply Co., Los Angeles.

Equipment Exports to Cover 800 New Wells

CHICAGO.—Equipment to drill and complete 800 wells in foreign countries will be exported next year, it was declared here last week by representatives of the Petroleum Administration for War who addressed conferences of equipment manufacturers during the annual A.P.I. meeting. Most of the export equipment, declared Don R. Knowlton and Frank A. Watts, PAW directors of production and materials, respectively, will be shipped during the first quarter of 1944 in order to reach foreign destinations in time to prosecute the drilling and completion program.

The domestic supply of tool joints is tight, the PAW spokesman admitted, but advised that this is being relieved. Two plants, it was reported, are being released from war contracts to resume manufacture of tool joints. By next March, the tool-joint supply should be close to normal.

Rock bits are at an all-time low, the entire stock amounting to 8-days' supply, but this is being corrected, manufacturers were advised. The situation is such that if consumers, manufacturers and distributors work through PAW and WPB the material and the facilities will be procurable to meet the expanding drilling program of 24,000 domestic wells in 1944, it developed at the meeting.

There is no doubt, Mr. Watts admitted, that the tool-joint-supply situation is already acute. He said that

Don't get left

Refiners who put off their post-war planning too long are likely to be left at the post—or at least, not to be in at the finish

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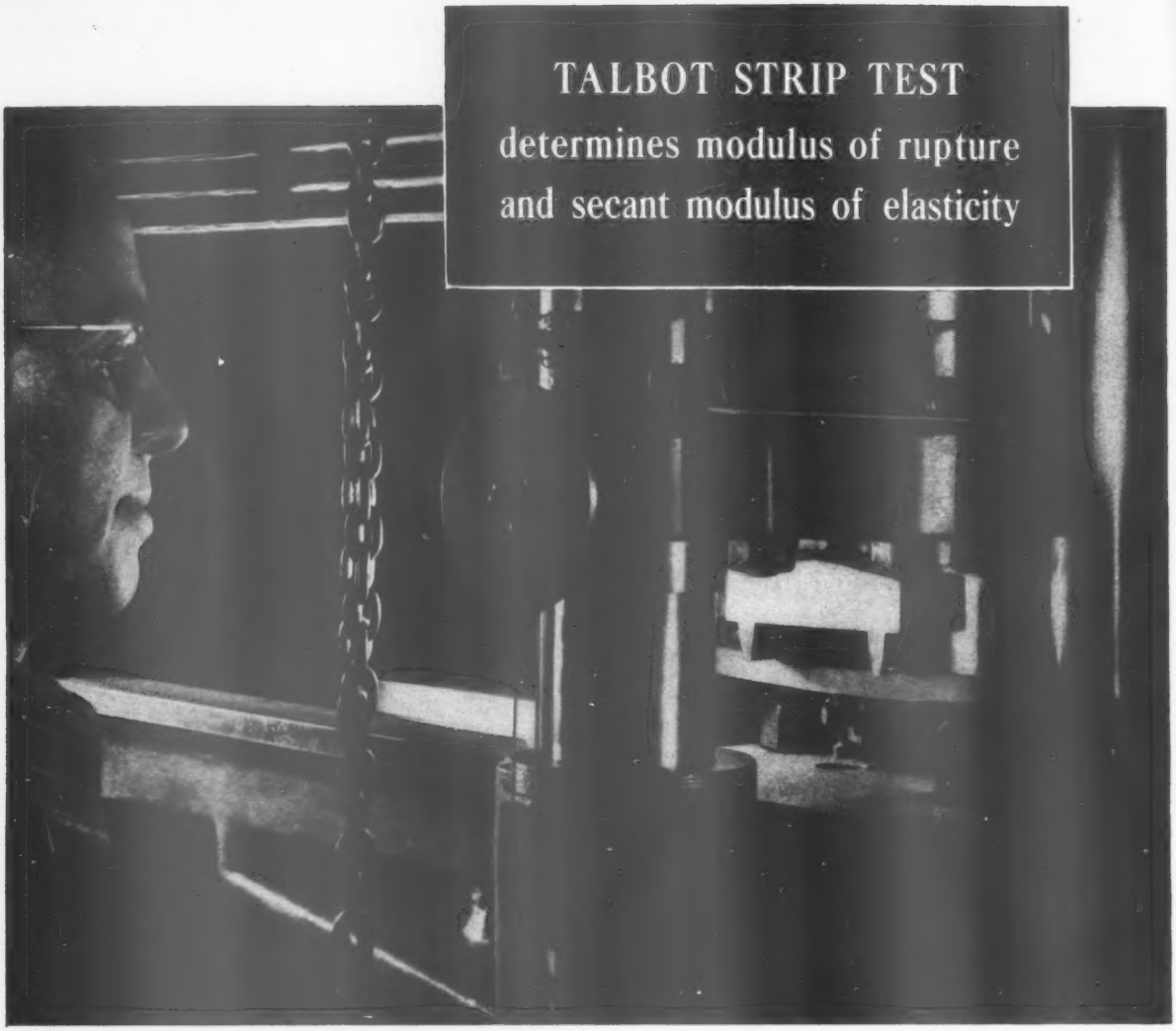

Remember cast iron pipe as you have always known it—inherently resistant to corrosion; but remember also that cast iron pipe founders have learned from the necessities of war. The cast iron pipe our members are making is lighter than heretofore considered necessary, and is therefore more economical, has greater tensile strength, and is, to state it bluntly, better cast iron pipe than you have ever before purchased, even more economical from the standpoints of first cost and cost per service year. Prompt deliveries on orders carrying requisite priority ratings. Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Ill.

CAST IRON PIPE

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a recent survey showed that there was a shortage but that no rigs had been shut down for lack of tool joints. Arch H. Rowan, Fort Worth, Tex., drilling contractor, pointed out that he knew of rigs being shut down for this reason. Supply men were rather anxious to see how the situation developed, some pointing out that there had been former indications that manufacturing facilities and material for the oil industry would be forthcoming but that the Army, Navy, and Lend-Lease representatives frequently blocked performance by the mills.

Essential Rating for Distribution Personnel Unlikely, Harbison Says

CHICAGO.—No group engaged primarily in distribution in any industry has an essential-manpower rating, Frederick H. Harbison, labor counselor for the Petroleum Administration for War, told the Petroleum Equipment Suppliers Association here November 10.

He stated that it was his opinion that it would be impossible to get an essential rating from the War Manpower Commission on a national basis for those engaged in distribution of oil-field equipment. He pointed out that if it were possible to obtain such a rating for the oil-equipment industry, then those engaged in distribution of all other industries would be aided similarly and the situation would be right back where it started.

The solution of the problem is to work through the regional boards and attempt thereby to have key men declared locally essential. This is the only avenue of approach which offers possible relief to this situation.

The Petroleum Administration recognizes field engineers and store managers for equipment and supply companies to be important positions. Field engineers now have been declared essential as repair parts specialists. The WMC, however, would not grant an essential rating for store managers, in Mr. Harbison's opinion.

The store manager ruling is not a complete turndown, for if it can be shown that he is engaged in field service, there is chance for deferment.

Overcoming the present manpower problem, according to Mr. Harbison, depends chiefly upon the ingenuity and the enterprise of the oil-equipment industry. The problem requires utilization of every possibility such as employment of women, older people, rearrangement of work schedules, adoption of the longer work week, development of vocational programs and similar matters.

Simplified Priority Forms Issued by PAW

WASHINGTON, D. C.—Speeding up the processing of applications for materials, the Petroleum Administration for War last week issued two forms to replace five forms previously used by oil-industry operators in obtaining priority assistance or authority to use materials.

Both new forms simplify application procedures and have been prepared to meet the particular needs of the petroleum industry.

PAW Form 30 now will be used to obtain preference ratings and allotments of controlled materials for operations as called for in P-98-b, amended. The form is used in applying for authority to use material in accordance with the provisions of PAO-15.

In addition, the new form must now be used in applying for exceptions under PAO-11 for natural-gasoline recovery, cycling and special production operations including gas desulfurization and dehydration operations, pressure-maintenance operations, gas-lift compression, or booster plants having a rated capacity in excess of 500 hp.

PAW Form 30 replaces WPB 617 (formerly PD-200), WPB 1548 (PD-200-b), WPBI 43 (formerly PDL-362), and PAW Form 4.

Under Form 30, operators will obtain priority assistance or use authorization more quickly than heretofore. About 7 days' processing time can be saved, if applications for construction projects are filled out in accordance with the instructions on the form, PAW said.

List of Materials Unchanged

To prevent confusion among operators, the Materials and Equipment List, which had been included as part of the instructions for Forms WPB 617 and WPB 1548, has been incorporated in PAW Form 30 without change.

Operators may speed up service by indicating on the envelope, as a part of the address when mailing applications to Washington, the appropriate branch of the petroleum industry (refinery construction, transportation, natural gas and natural gasoline, marketing, or oil production).

PAW Form 35 replaces WPB-2565 (formerly PD-873) and is used as an application for allotment of controlled materials in production operations as set forth in Order P-98-b. Its use remains the same as that of former WPB-2565, except for the special production operations, under PAO-11, when Form 30 will be used. Form 35 must be filed in all cases with the respective district offices of PAW.

Magnolia Operators Plan Disposal and Pressure Project

EL DORADO, Ark. — Definite steps toward launching Arkansas' second combination salt-water disposal and pressure-maintenance project are expected to be taken at a meeting here November 23.

It is the proposed program for the Magnolia field, known as the model pool for Arkansas, and would be similar in many respects to the same type of project which is proving successful in the Midway field of Lafayette County.

Discussion of the program will be between executives of all companies operating in the field. They have been invited to the meeting by O. C. Bailey, chairman of the Arkansas Oil and Gas Commission, which went on record at its last state-wide hearing in favor of such projects.

Petroleum engineers of the state commission, and engineers representing at least some of the Magnolia operators, have engaged in preliminary discussions and preliminary studies. Use of old and new wells has been discussed, and indications have been that most of the operators probably will favor drilling new wells on the edges of the field.

W. L. Horner, in charge of the secondary-recovery department of the Barnsdall Oil Co., has been invited to attend the gathering, and is expected to give detailed information about the injection of water into wells in the Midway field. One injection well has been used in that area since last March, and three additional such wells have been authorized by the state commission with all interests in the pool unitized for the program.

Chicago Corp. Plans Cycling Plant for Panola County

MARSHALL, Tex.—Clyde Alexander, of Dallas, Tex., representing Chicago Corp., is reported to be planning construction of a cycling plant in the Carthage condensate field, Panola County. Mr. Alexander is said to be negotiating for an interest in gas distillate properties. These properties, it is understood, would be assigned to Tennessee Gas & Transmission Co.

Engineers Discuss Salt-Water Disposal

(Continued from page 15)

During his discussion he stressed the need for more study of the amount and character of gas present in waters from producing horizons. "Work should be done," he said, "to determine what part, if any, the small amount of gas contained in salt water plays in the recovery of oil from the reservoir."

Oil-Field Brines Studied

F. W. Rolshausen, chief paleontologist, and F. W. Jessen, in charge of the service department of the petroleum engineering laboratory, Humble Oil & Refining Co., Houston, Tex., presented a paper resulting from a rather extensive study of the salt waters of the Frio formation on the Texas Gulf Coast. The practical application of such a study is obvious, since not only geologic, but also production problems, arise in connection with the salt water produced with oil. A study of this type also permits correlation of waters occurring above, in or below the producing sand in the same field, or occasionally even between different fields, it was pointed out.

Charles Warner, Houston Oil Co., gave a report on the recent Los Angeles meeting of the A.I.M.E. Dr. Fred Bullard showed colored slides of the new volcano in Mexico.

Negotiations Suspended

(Continued from page 12)

Ltd., is the sole operator. The British Government holds approximately 50 per cent of the Anglo-Iranian stock. It was assumed here that PRC would acquire title to a fixed percentage of interest in the Anglo-Iranian holdings in event RFC funds are advanced for additional drilling and installation of more refining capacity.

Another indication that important developments were occurring in PRC negotiations was given last week by early return of E. Holley Poe, general manager, who spent only 1 day at the Chicago meeting of the American Petroleum Institute.

Meanwhile, it was learned that representatives of the PRC, including E. DeGolyer, consultant; John Murrell, assistant consultant, and W. E. Wrather, chief of the U. S. Geological Survey, have departed for the Near and Middle East fields and refining centers for inspection of facilities and for analysis of problems concerning greater use of foreign-oil supplies.

Rumors previously current in the petroleum industry that the Allied high command planned to build a product pipe line from Calcutta, India, to Chungking, China, broke into general news dispatches last week from Chicago. The reports were that China, Great Britain and the United States would build a 6-in. line between the two far eastern terminals, crossing through the northern tip of Burma which remains in Allied hands. The line would be approximately 2,000 miles long and would cross one range of the Himalaya Mountains. Delivery to the Calcutta intake would be handled by tankers loading in the Persian Gulf. The tanker route around India would cover approximately 3,800 miles. Since loss of the Burma Road, most petroleum supplies reaching China have been flown in by large air transports.

Hildreth Development Showing Promise

(Continued from page 18)

there to the producing section in the conglomerate depends on the particular zone tapped. One well showed some production in the top the Caddo but five wells show that it is approximately 54 ft. from the top of the formation to the pay. Another pay zone was picked up in three of the wells at approximately 74 ft. under the top, and the Continental 2 Clisbee showed additional pays at 190 ft., 219 ft. and 239 ft. from the top of the formation. There has not been sufficient testing in all wells to show whether all of the six pay zones are present in each of the wells.

The section between the Caddo and the Ellenburger is fairly uniform over the field and shows little tendency of the structure to sharpen with depth. Whether the Ellenburger in the field will compare with the Caddo as a producing zone is not known as it has not been adequately tested in any but the discovery well. However, casing was run to total depth, or to the top of the Ellenburger pay, in all wells drilled to that zone. Drill-stem testing of the Ellenburger indicated possibilities. Wells drilled to the conglomerate have casing of sufficient size to permit deepening later if it is decided to exploit the Ellenburger.

Wells in the Caddo pay are allowed 140 bbl. per day. Oil produced in the field is purchased by the Sinclair Crude Oil Purchasing Co. and enters Sinclair Pipe Line Co.'s line between Bowie, Tex., and Ringling, Okla.

Mid-Continent Discovery Flowing 15 Bbl. an Hour

Mid-Continent Petroleum Corp.'s pool opener, 1 Edgar Harris, NE SE SW 29-10n-3w, Cleveland County, Oklahoma, about 6 miles southwest of the Oklahoma City pool, this week started flowing 15 bbl. of fluid an hour through 1½-in. orifice in the bit and ⅛-in. choke on tubing from second Wilcox at 8,780-92 ft.

The well cleaned itself in 40 minutes of mud and wash water and the flow was said to be 96 per cent oil and clearing up rapidly. Gas was estimated at 7,000,000 cu. ft.

DEATHS

W. L. Robinson, 67, retired oil-field executive, died last week in his home in Houston, Tex. Mr. Robinson went to Texas from Mississippi in 1924, and at the time of his retirement was field manager for Pratt-Hewett Oil Co. in the Refugio field.

Henry Oliver Brown, 59, employe of Cities Service Oil Co., Ponca City, Okla., died in a hospital in that city after suffering a heart attack.

James P. Logal, pioneer driller and drilling contractor in the northwestern Ohio fields, died at his home in Jerry City, Ohio, on November 10.

Glenn E. Harris, 49, who until his illness a year ago was employed at the Sinclair refinery at Sand Springs, Okla., died at his home in that city last week.

Fred M. Carter, attorney for Indian Territory Illuminating Oil Co., Bartlesville, Okla., until his retirement 5 years ago, died November 8 in Greenwich, N. Y. Mr. Carter moved to Okmulgee, Okla., from Kentucky 25 years ago and engaged in law practice, later joining I.T.I.O. Upon his retirement he moved to Franklin, Tenn., where the body was sent for interment. A daughter, Mrs. C. H. Lieb, is the wife of the president of Creole Oil Corp., and former president of Carter Oil Co.

V. H. Donihoo, 43, employed in the comptroller's department of Humble Oil & Refining Co., Houston, Tex., died last week in that city.

Nathan A. Beighley, 70, retired employe of the Joseph Reid Gas Engine Co., Oil City, Pa., died last week. He was a veteran of the Spanish-American War.

Irwin Earl Boyett, 68, oil man and land owner, died last week in Shreveport, La. Mr. Boyett went to Louisiana in 1931 and settled in Alexandria, when he could keep oversight of extensive holdings he acquired in Avoyelles Parish.

Fred Bock, 34, employe of the Lee Drilling Co., died in a hospital in Duncan, Okla., last week, of injuries suffered in an accident while working on a drilling rig near Velma, in Stephens County, Oklahoma.

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Thanks

For gallant ships and the men who man them . . .

For fighting planes and the boys who fly them . . .

For the inspired plans of our military leaders and the courage of the lads who carry them out . . .

For the energy and sacrifice of the millions of workers who are making production history on the home front . . .

For these, we have reason indeed to be grateful; for in their strength and power lie the hopes and fate of civilization . . . Gaso Pump & Burner Mfg. Co., 902 E. First Street, Tulsa, Oklahoma. Export Office: 149 Broadway, New York. Shreveport: W. L. Somner Co., 419 Lake Street. Los Angeles: Service Oil Field Supply Co., 5333 S. Riverside Drive.

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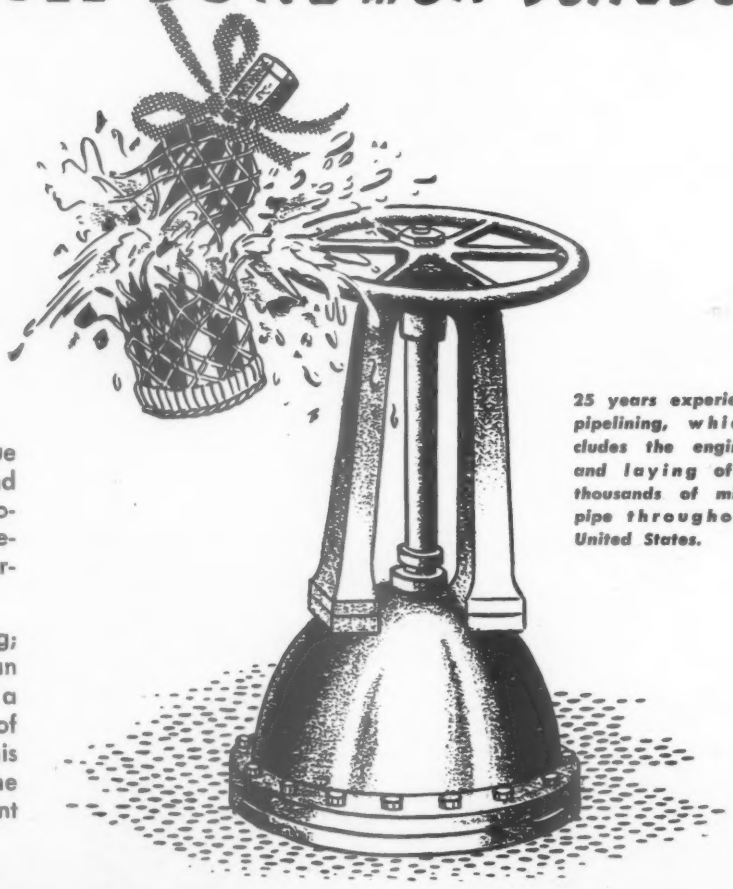

By December first, the Oklahoma Contracting Company will have completed all its sections on the Little Big-Inch Pipe Line—a job well done and *on schedule!*

Our fine record of performance is due chiefly to the spirit of the men behind this organizaiton, and the splendid co-operation of the War Emergency Pipelines, Inc., and the Defense Plant Corporation organizations.

Pipeliners like C. R. Ice and gang; P. A. Thurman and gang; C. L. Boatman and gang—these fellows really make a pipe line construction team tick. All of us are proud to have been a part of this vital project, and we're confident the petroleum industry and our government can be proud of our work.

25 years experience in pipelining, which includes the engineering and laying of many thousands of miles of pipe throughout the United States.

OKLAHOMA CONTRACTING COMPANY

DALLAS, TEXAS

Dehydration of Saturated Well Gas In Subfreezing Weather

by Neil Williams

In areas where extreme cold temperatures are experienced, special precautions must be taken in producing low-pressure gas to eliminate all water vapor which might form hydrates and freeze in transmission lines. In this article typical practices of one producing company in Wyoming to dehydrate saturated gas are described.

GAS produced in many fields of the Rocky Mountain area often carries a high saturation of water vapors. Particularly where the volume of production has been reduced and pressures are low, the gas becomes supersaturated to the extent appreciable quantities of free water may travel mechanically in the lines. During the winter season when temperatures in this district much of the time are far below the freezing point, at times as low as 30° to 40° F. below zero, freezing of water and condensate that might drop out in the lines with reductions in temperature and pressures from the wells constitutes a major hazard. The danger of freezing is accentuated in this area not only because of the severe cold spells but because the water is fresh, freezing more readily and at much higher temperatures than if it were brine.

The severe cold spells in themselves are not an important factor so far as the main gas lines are concerned as most of these lines are buried at such depths that they are unaffected by periodic fluctuations in surface temperatures. It has been learned by records kept over a period of many winter seasons that the temperature in these lines does not drop below 26° to 28° F., regardless of how low the temperature is at the surface, and also that this temperature remains fairly constant until after the ground thaws. However, even at that temperature fresh water condensate will freeze, and once frozen, reopening of a deeply buried line is difficult, sometimes impossible because of the hardly frozen ground above.

Because of this, it is essential that the gas be dehydrated before reaching these lines to a dew point so low that there will be no chance of any condensation of water vapors at the temperature and pressure in these lines. This calls for careful control of temperature drops in the flow of the

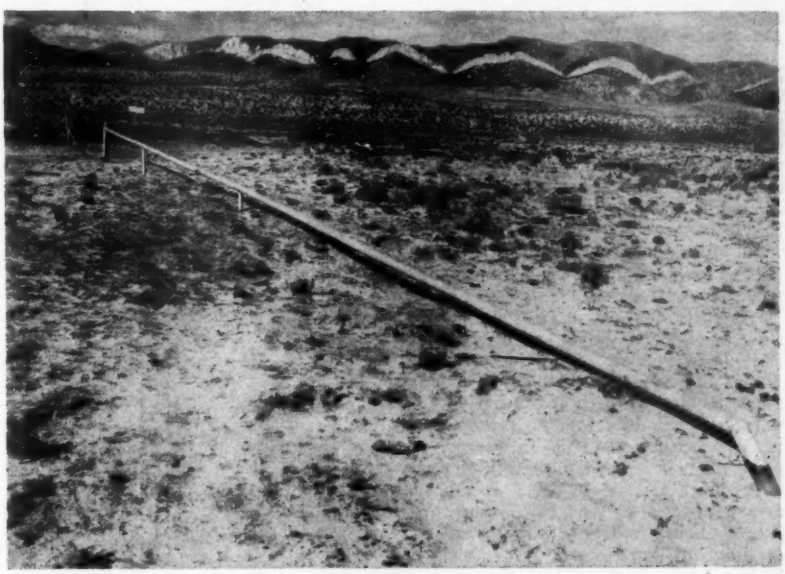

Fig. 2: Long, aboveground flow line in second dehydration stage. "Stinger" for draining first-stage drip at extreme left

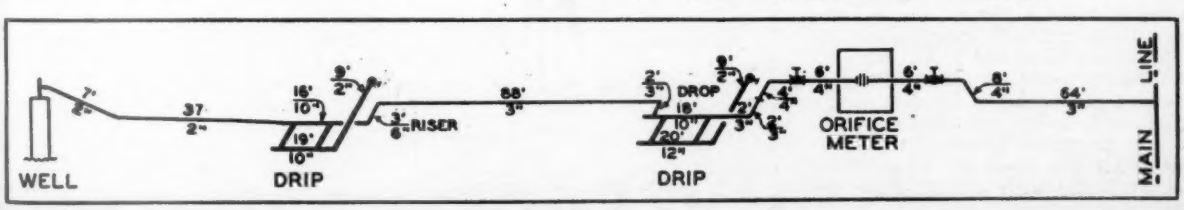

Fig. 1: Typical gas flow system employing atmospheric cooling for elimination of hydrates

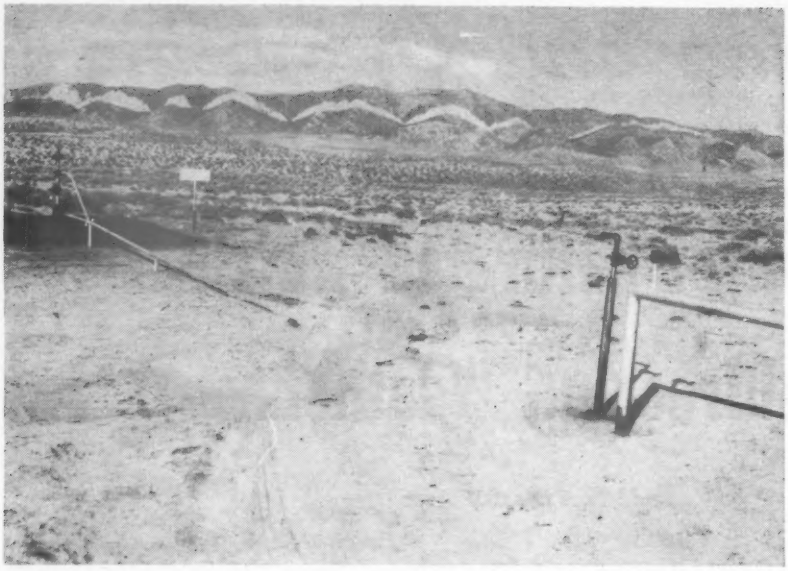

Fig. 3: Graded flow line from well to first-stage drip. "Stinger" for draining drip trap at right

gas from the wells to the buried lines and removal of the water and condensate in traps at places and under conditions that no freezing will result.

Systems generally provided consist of long, aboveground flow lines from the individual wells, utilizing atmospheric temperatures for cooling the gas. Sizes and lengths of the lines, together with the size and spacing of the traps, are dependent upon the volume of gas and its saturation, temperature of the gas at the well, the desired temperature differentials between the well and the traps, and other factors. Because of the relatively small volumes of gas produced from these wells, elaborate and large-scale dehydration and flow systems generally would not be economically practical or feasible.

An unusually effective dehydrating flow system is being employed by Sinclar - Wyoming Oil Co. on gas wells in the Mahoney and Ferris fields located in Carbon County, Wyoming. In this the gas is dehydrated in two stages, and is delivered to underground lines completely dry at a temperature of 20° F., at 75 lb. pressure, on the basis of temperature drops during extreme cold weather. A diagram of the system is shown in Fig. 1.

Gas produced in these fields has a supersaturation of water vapors. The combined fields, which are handled as one operation in supplying utility lines, have produced more than 77,000,000,000 cu. ft. of gas, and current volume produced has dropped so low that wells make considerable water at low pressures. Normally the gas is so wet that it could not be produced economically with a large-scale dehydration system.

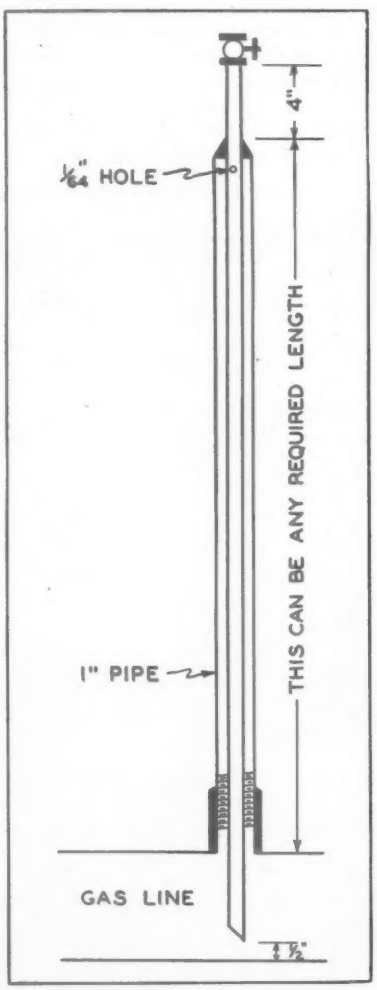

Fig. 4: "Stinger" for draining water traps and low places in lines

At the maintained well pressure of 75 lb., the gas carries 165 lb., or approximately 19.8 gal. of water vapor per million cubic feet. The particular well shown in the accompanying pictures is making about 233,000 cu. ft. of gas daily. At the above rate, the water vapor saturation in this volume would be a little more than 38 lb., or slightly more than 4½ gal.

From the well there is an elevated 2-in. flow line, graded slightly downward and extending 37 ft. to where it drops steeply underground to the first drip. The drip consists of a bottom drum, 19 ft. long and 10 in. in diameter, with two risers to an upper drum, 16 ft. long and 10 in. in diameter. These are fabricated from sections of pipe. The bottom, in which the water accumulates, is from 6 to 7 ft. underground, while the upper drum, through which the gas passes, is at a depth of from 3 to 4 ft: The sizes and design of the drips may differ, however, in the various installations, the principal factor being to provide sufficient capacity to handle the volume of water vapor expected to be recovered.

Temperature of the gas at the well head in this case will run about 63° F. In the travel of the gas through the first section of flow line to the first drip, the temperature, in extreme cold weather, will drop 20° to about 43° F. At this temperature, approximately 79 lb., about 9.48 gal., of water vapor will drop out in the drip per million cubic feet of gas. At present rate of production of this well, about 18.4 lb., or 2.2 gal., of water will be removed daily at this point. As the minimum temperature is 43° F., there never is any danger of freezing in this dehydration stage.

Second Stage of Dehydration

Gas leaving the first drip still carries approximately 86 lb., or 10.32 gal., of water vapor per million cubic feet. Outlet from the first drip is through a 3-in. line which rises almost vertically about 6 ft., to a level about 3 ft. aboveground. This line, aboveground, then extends 88 ft., grading slightly downward, and then drops underground again to the second drip. The length of this elevated line may vary from well to well, according to the cooling range desired for the gas. The second drip in this installation is similar to the first except the lower drum is 20 ft. long with a diameter of 12 in. to provide greater water-accumulation capacity, while the upper drum is 18 ft. long with a diameter of 10 in.

Through this second line, temperature of the gas will drop another 23° to a low of approximately 20° F. At this temperature an additional 52 lb., or 6.24 gal., of water per million cubic feet of gas will drop out in the second trap, leaving only 34 lb. of water vapor per million cubic feet in the gas. Since the lowest line temperature is somewhat above 20° F., the re-

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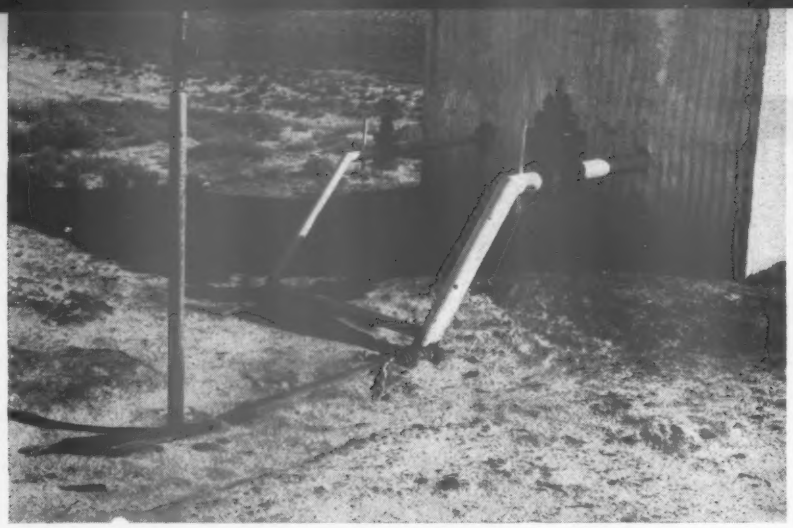

Fig. 5: Gas outlet from second-stage drip trap to housed meter run. "Stinger" for draining trap is shown in foreground

maining water in the gas will continue as a vapor in the line and no freezing will result. At the temperature of 20° F., pressure of the gas would have to be boosted to approximately 165 lb. to form hydrates.

For metering, the gas again is brought to the surface from the outlet of the second drip. (Fig. 5). The meter run, with the orifice and meter, is housed, and since the travel of the gas before it is returned to the ground is comparatively short, there is very little chance for any appreciable further drop in the temperature that might cause an additional precipitation of water vapors. The line out of the ground from the drip and through the meter run is 4 in. As it goes back underground to the field gathering system it is reduced again to 3 in.

Lines within the field to the main line usually are not buried more than 12 to 18 in. so that if any further condensation of vapors should occur, and result in freezing, these lines can be dug up and thawed. This might not be possible if the lines were buried deeply and the ground were frozen hard, which usually is the case through most of the winter in Rocky Mountains. Usually, any additional water to be formed would drop out in within a short distance, and before it would have a chance to get in the main lines.

Drainage of Drips

At the temperature of 20° F., it is possible that the water vapors dropped out of the gas in the second dehydration stage and in the second drip could freeze. However, since the line is graded downward to the drip, any water formed drains fairly rapidly, and ordinarily there would not be sufficient time interval in passage through the line for the water to freeze. Should the water freeze in the line, it could be thawed readily with application of heat as the line is aboveground. Water collecting in the drips is drained frequently in subfreezing weather, so there is little chance of the water remaining at those places long enough to freeze.

Drips are drained by means of "stingers," special devices (see Fig. 4) which permit blowing the accumuated water by means of the gas pressure in the drips. These devices also are placed at all low places in the field and main lines where water, if formed, would accumulate. The device consists of an outer pipe screwed into a nipple welded into the top of the trap or line, and extending to any desired height aboveground. A small-sized pipe, usually ½ in. in diameter, is fitted inside the larger pipe. The bottom end of this is open and is set at a level near the bottom of the place where the water accumulates. The top end, on which a small valve is attached, protrudes above the top of the outer pipe, into which it is sealed. A small hole is drilled in the small pipe at a point below the top of the outer pipe to permit equalization of gas pressure inside and on the outside of the small pipe. When the valve at the top is opened, the accumulated water in the bottom of the trap or line is blown out by the pressure in the system.

Gas entering the main lines will drop a small amount of water, amounting to about 7 gal. per 35 miles, due to the gradual reduction in pressure. This, however, is water condensate and not hydrates formed by cooling. To accumulate and remove this condensate, traps are installed at appropriate places along the lines.

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The sheet is first rough-cut to shape by torch from the stock desired of any required thickness. This shape is machined to outer dimensions, over all.

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These holes are then countersunk on the tube-entering side to about 60° bevel to guide the tubes in when fitting them to the header, using for this an air-driven borer on a flexible spring support permitting easy lowering and raising of the borer assembly.

A special grooving tool cuts grooves in the inside face of these tube holes, into which the tube ends are to be rolled. Holes are then reamed to full size, to fit tubes and to remove burrs, ready for insertion of tubes.

Tubes are inserted, and rolled into their holes, by means of an air-driven, rolling tool which forces the tube metal out into the grooves giving a tight, liquidproof joint. (Courtesy Gulf Refining Co.)

Section of shop where new tube sheets are drilled using template as discussed

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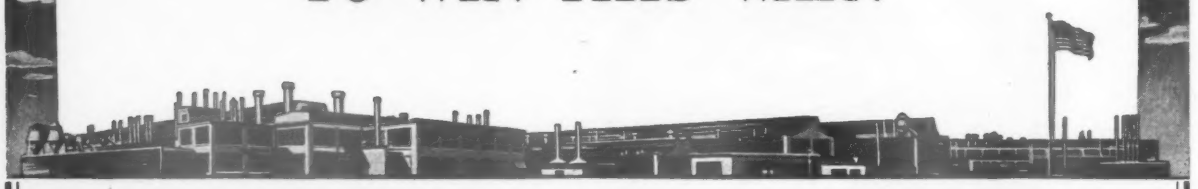
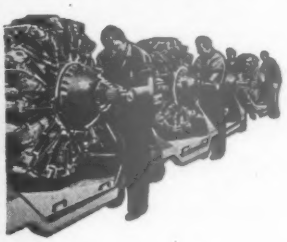


Two Types of Pratt & Whitney Aircraft Engines, One for B-24 Liberator Bombers and One for C-47 and C-53 Cargo Planes



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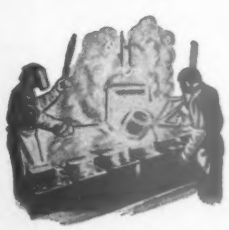

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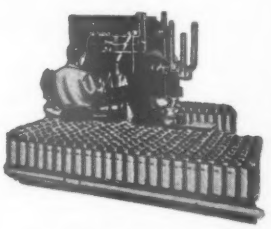

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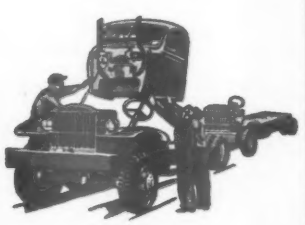

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FLUID CATALYST CRACKING

For Premium Fuels

by E. V. Murphree, H. G. M. Fischer,* E. J. Gohr,* W. J. Sweeney* and C. L. Brown†*

FLUID catalyst cracking plants embody a new chemical engineering technique wherein solids are handled in a "fluid," or freely moving, state such that a solids mass can be circulated much in the same way as a liquid. Practically, the application of this technique in the catalytic cracking of petroleum has resulted in substantial simplifications in design, and operating ease over conventional fixed-bed processes, and also has imparted to the fluid-type catalytic plants a degree of flexibility in control of operating variables such as has not been heretofore possible with either the fixed or the moving-bed type of catalytic plants. A simplified flow diagram illustrating the essential features of the first commercial fluid catalyst plant design is presented in Fig. 1.

A fluid plant, as indicated in the diagram, is composed of essentially three sections: viz, cracking, regeneration, and fractionation. The cracking reaction takes place continuously in one reactor, the spent catalyst being removed (and replaced) continuously for simultaneous regeneration in a separate vessel. Continuity of flow of catalyst, as well as of oil, thus is accomplished—with the result that the characteristic features of fixed-bed designs involving the intermittent shifting of reactors through cracking, purging and regeneration cycles are eliminated. The flow through the plant is as follows:

Regenerated catalyst from a storage hopper flows by gravity down through a standpipe wherein a pressure head is built up on the catalyst. The latter then is injected into the fresh oil vapor which carries the catalyst to the cracking reactor. The velocity in the reactor is low so as to maintain a high concentration of catalyst, and cracking occurs with a subsequent deposition of carbon on the catalyst. Although high concentrations of catalyst are obtained in the reaction vessel, the solid-gas mixture is extremely turbulent and resembles a boiling liquid in many respects. The mixture of cracked products and spent catalyst from the cracking zone are separated in dust-recovery equipment. The cracked products flow to fractionating equipment for separation into desired components. The spent catalyst drops into a storage hopper, flows down a standpipe, is picked up by an undiluted air stream, and is carried to the regenerator in which carbonaceous deposits are removed by combustion. The mixture of flue gas and catalyst from the regenerator are separated, the catalyst dropping into the regenerated catalyst hopper to complete its cycle.

*Standard Oil Development Co., Elizabeth, N. J. †Standard Oil Co. of Louisiana, Baton Rouge, La.

A.P.I.

A number of large-scale fluid catalyst cracking plants are now in operation producing highly aromatic aviation-base stocks, raw materials for alkylate, synthetic rubber, and toluene. The latest of these plants are of a new and simplified design, and more than 30 of such plants are being brought to completion. Long continuous runs have been obtained, and operation has been characterized by wide flexibility in operating conditions and ease of control. Erosion has been low, and maintenance requirements for initial operations have been at the rate of 5 to 6 per cent per year of the capital investment. Catalyst losses on the unit at Bayway, N. J., recently have averaged 0.12 to 0.26 lb. per bbl. of charge. This is a slightly abbreviated version of a paper presented before the Division of Refining, A.P.I. meeting, Chicago, Ill., November 8-11.

The heat evolved from the combustion of the carbon deposited on the catalyst is utilized to preheat gas-oil feed and also to produce steam. In order to avoid excessive temperature increase in the regenerator, catalyst is recycled through a separate standpipe and through oil coolers, as shown in Fig. 1. Subsequent development has indicated that it is feasible, moreover, to dissipate a greater portion of the heat of combustion to the preheating of fresh feed by introducing the hot catalyst directly into the cold oil, eliminating thereby the need for externally fired vaporizing equipment.

Operation of the fluid cracking plant is virtually automatic. The rate of catalyst flow, for example, is con-

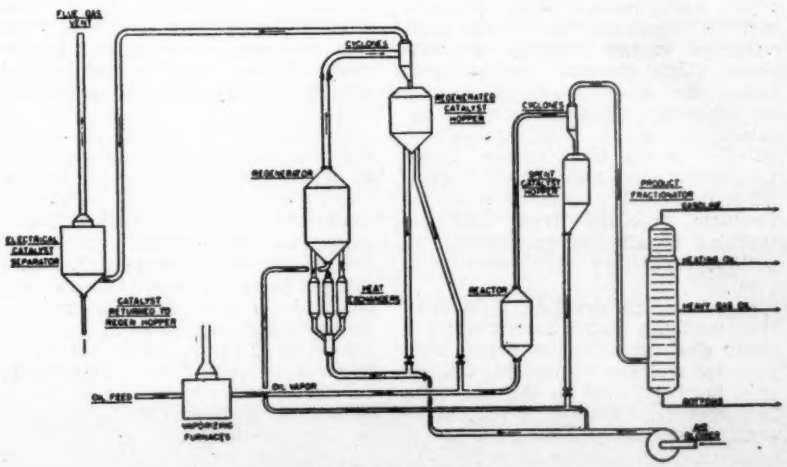
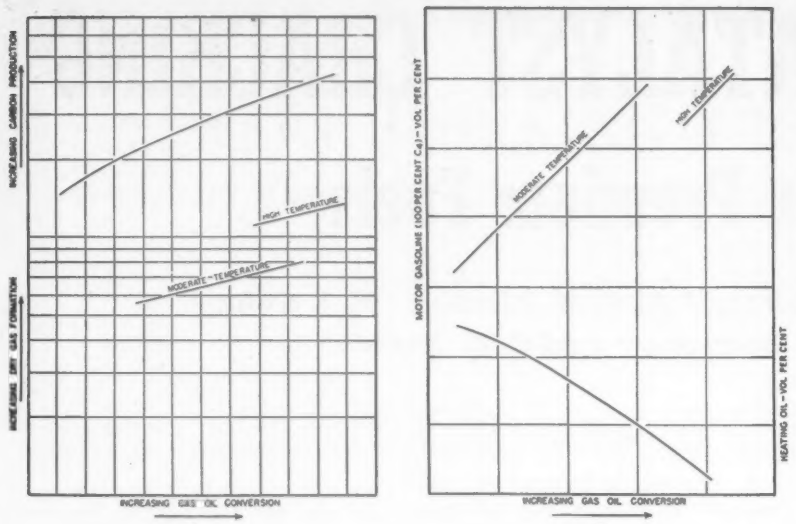


Fig. 1: Fluid catalyst cracking plant



Product distribution; commercial operations; natural catalyst; heavy paraffinic gas-oil feed

Fig. 2: Fluid catalyst cracking for motor fuel

trolled by a mechanism actuated by changes in the density of the catalyst-oil mixture. Flow of catalyst to regeneration is regulated by the level of catalyst in the spent catalyst hopper. Similarly, regeneration temperature is governed by automatic control of the quantity of catalyst circulated through the heat exchangers.

Reaction temperatures can be varied by the quantity of heat applied to the oil in the furnaces and also very substantially by the amount of hot catalyst circulated. Liquid or vaporized stocks are processed with equal ease. In commercial operations, reactor temperatures have ranged from 800° to 1,000° F. Regeneration temperatures similarly can be varied widely, and are maintained normally between 1,000° and 1,200° F. The depth of cracking may be governed independently of temperature by the ratio of catalyst to oil flow and by other process variables. Because of the method employed in handling the catalyst, exceptionally large amounts can be circulated, permitting great variation in the intensity of treatment. High cracking temperatures, above the range normally possible by other processes, are readily obtained through the high catalyst circulation in the fluid process. These features are of considerable importance, inasmuch as the character of products resulting from catalytic cracking is affected extensively by both temperature and conversion level.

In general construction, fluid catalytic cracking plants do not differ a great deal from conventional low-pressure refinery equipment. Carbon steel has been used for the most part in the plants, and most of the equipment is of conventional type. Moreover, the plants are characterized by the absence of timing devices and mechanical equipment for circulating the large quantities of catalyst. No unusual equipment has been designed to combat erosion, because this has been controlled primarily by proper choice of velocities, streamlining, and use of protective wear plates.

The newer design fluid plants differs in several major respects from that typified in Fig. 1 and, as a consequence, are simpler and more compact in design and in construction, in addition to being inherently more flexible in operating characteristics.

Operating Performance

The basic soundness of the fluid catalyst technique as applied to the cracking of petroleum has been amply demonstrated by present commercial experience. Continuous runs of as long as 5 months have been achieved, and 6 months' maintenance requirements for the initial operations of the Baton Rouge and Bayway plants—which include minor revisions to equipment—have been found to be at the rate of 5 to 6 per cent per year of the capital investment. Normal requirements should thus be considerably below thermal cracking.

The recovery of catalyst, in general, has been satisfactory, despite periods in which high losses were experienced because of faulty mechanical conditions in the dust-collecting equipment. In 9 months of operation on the Baton Rouge unit, actual catalyst losses averaged about 0.4 lb. per bbl. of feed. This figure includes rather high losses in the starting up of the unit, which should be eliminated with future experience. On the Bayway unit over-all losses during the past 4 months have shown an average of 0.26 lb. per bbl. This included one turnaround period during which higher losses are normally obtained. Losses on this unit for the past month have averaged 0.12 lb. per bbl. Minor improvements and adjustments to the catalyst-recovery equipment in all plants are being continued to achieve better efficiency, and it is expected that catalyst losses from a large commercial fluid catalyst unit ultimately will be around 0.15 lb. per bbl.

Maintenance of catalyst activity in the commercial plants has been satisfactory. Inasmuch as a continuous replacement of catalyst inventory occurs by the addition of fresh catalyst to replace losses, fluid catalyst achieves what might be termed an equilibrium activity, and no replacement of the total inventory is made periodically as with conventional fixed-bed catalyst processes. The catalyst in most of the commercial fluid units has reached this state, and its performance as regards cracking ability and product distribution has been in accordance with expectations.

The flow of fluidized solids in commercial operation has been characterized by the same smoothness and ease of control experienced in the pilot-plant development work. Erosion of equipment by the circulating catalyst has not been serious. Such erosion as has been found is being reduced progressively, and it is expected that this factor ultimately will be virtually eliminated. Repair-materials requirements for the Baton Rouge and Bayway units have been at the rate of 0.8 to 1.7 per cent per year of the capital investment.

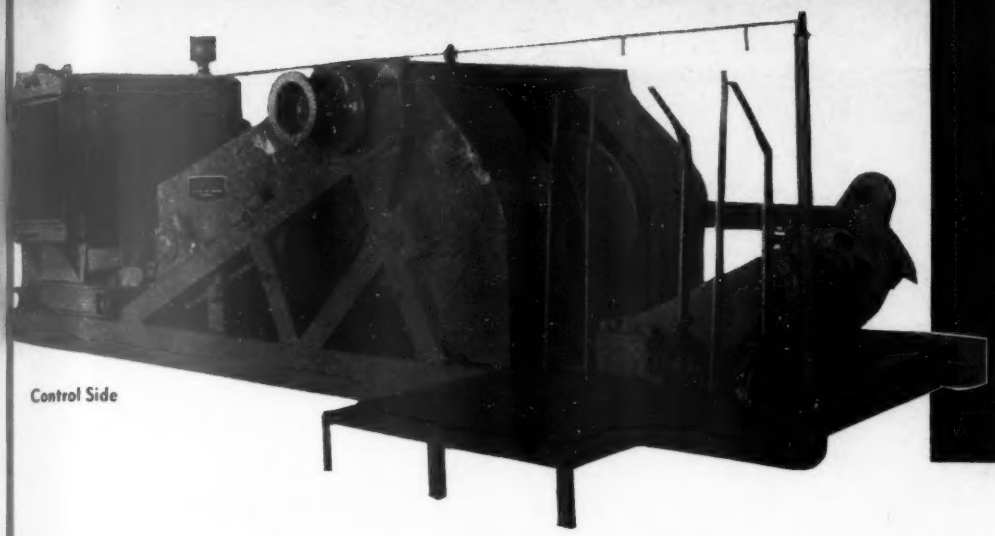
Motor-Fuel Operation

Catalytic cracking for motor-gasoline production normally is carried out by contacting light and heavy crude fractions with catalysts at moderate temperatures in single-pass operations. Commercial fluid operations

TABLE 1
Quality of Motor Fuel From Commercial Operation With Synthetic Catalyst

Feed properties:	
Gravity, °A.P.I.	34.7
Initial boiling point, °F.	412
50 per cent point, °F.	586
End point, °F.	752
Motor-gasoline properties:	
Gravity, °A.P.I.	55.0
Reid vapor pressure, lb.	10.1
Sulfur, per cent by weight	0.04
Copper-dish gum, mg. per 100 ml.	10
Breakdown, hours	13
Acid heat, °F.	138
Initial boiling point, °F.	93
Per cent over at:	
158° F.	27.0
212° F.	46.0
284° F.	64.5
90 per cent point, °F.	360
End point, °F.	390
Octane No.:	
A.S.T.M.: with no addition of TEL	82.6
CFR-R: with no addition of TEL	96.2
plus 1.5 ml. TEL per gal.	99.2
plus 3.0 ml. TEL per gal.	S+0.01*

*Reference fuel "R" plus 0.01 ml. TEL per gal.



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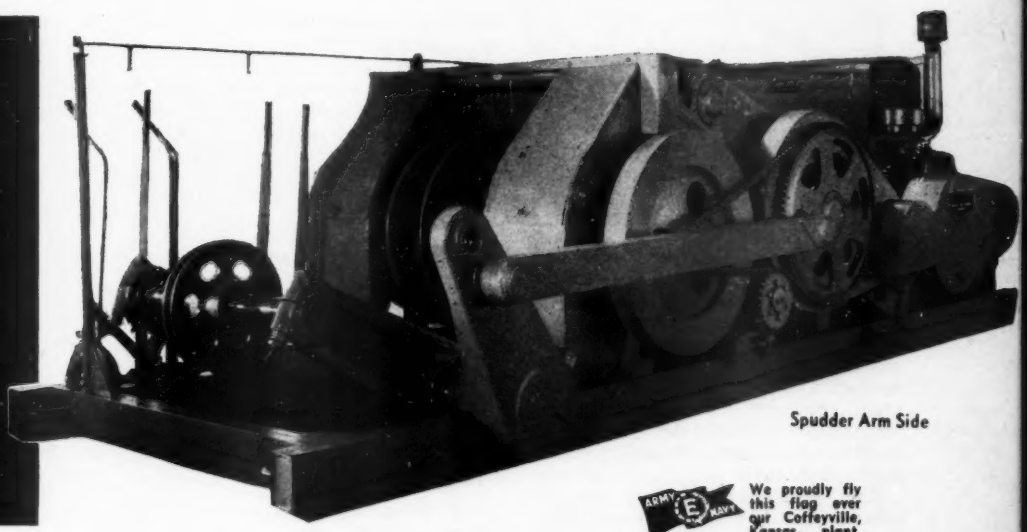

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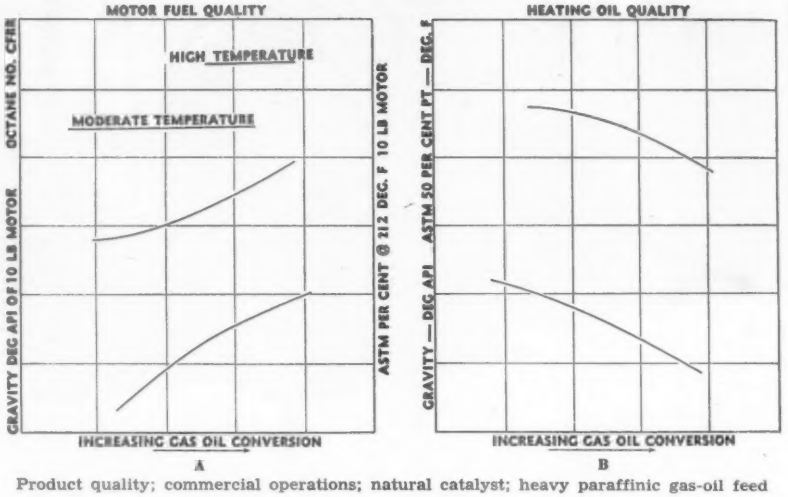
TABLE 2

Comparison of Commercial and Pilot-Plant Cracking to Obtain Motor Gasoline—Using Natural Catalyst

	Commercial scale	Pilot plant
Feed stock:		
Gravity, °A.P.I.	30.5	31.7
50 per cent point (A.S.T.M. distillation) °F.	690	680
Yields on feed (per cent by volume):		
Gasoline (10 lb. Reid vapor pressure)	42.0	45.0
Excess butane	7.5	4.7
Gasoline (100 per cent C_4)	49.5	49.7
Gas oil	50.0	50.0
Dry gas, per cent by weight	6.2	5.0
Carbon, per cent by weight	2.8	2.8
Motor-gasoline properties:		
Gravity, °A.P.I.	60.3	60.4
A.S.T.M. distillation:		
Initial boiling point, °F.	101	95
Per cent over at:		
122° F.	5.5	5.0
158° F.	22.5	24.0
212° F.	45.0	46.0
257° F.	64.0	61.5
356° F.	92.5	90.0
End point, °F.	385	400
Color	+20	+20
Aniline point, °F.	85	87
Sulfur, per cent by weight	0.03	0.04
Bromine No.	93	75
Octane No.:		
A.S.T.M.: with no addition of TEL	79.2	79.7
CFR-R (1939): with no addition of TEL	92.9	92.0
plus 1.5 ml. TEL per gal.	97.3	97.0


MOTOR FUEL QUALITY
HIGH TEMPERATURE
MODERATE TEMPERATURE
OCTANE NO. CFR
GRAVITY DEG API OF 10 LB MOTOR
ASTM PER CENT @ 212 DEG. F 10 LB MOTOR
INCREASING GAS OIL CONVERSION
A
HEATING OIL QUALITY
GRAVITY — DEG API ASTM 50 PER CENT PT — DEG. F
INCREASING GAS OIL CONVERSION
B

Product quality; commercial operations; natural catalyst; heavy paraffinic gas-oil feed

Fig. 3: Fluid catalyst cracking for motor fuel

for motor fuel to date have been limited to brief periods with the purpose of establishing operability of equipment before proceeding with regular war-products operations with synthetic catalyst. The initial period of operation at the first Baton Rouge plant, however, was of sufficient length to establish the yields and quality of products on a large-scale production basis.

The wide-cut paraffinic gas oil processed in the Baton Rouge plant during this period resulted in the product distributions as indicated in Fig. 2. Cracking temperatures and depth of cracking, both of which were varied over relatively wide ranges, each have an effect of yields of various components. With a given temperature, motor-gasoline (100 per cent C_4) yields ranging from 43 to 53 per cent were obtained depending on the level at which conversion was maintained; dry-gas and carbon production increased simultaneously, at the expense of yield of the heavier products. Cracking at higher temperatures resulted in a decrease in motor-fuel production, with a corresponding increase in dry gas, for a given conversion of gas-oil feed.

Quality characteristics of the motor fuels and heating oils which correspond to the yields presented are summarized in Fig. 3. Antiknock quality of the motor-fuel product (with no addition of TEL and with a Reid vapor pressure of 10 lb.) obtained from cracking operations at moderate temperature with the paraffinic gas oil showed a CFR-R octane number of approximately 92, regardless of conversion level. Operations at high temperature, however, resulted in a higher-quality product, viz., one with a CFR-R octane number of approximately 94—presumably because of the larger amount of olefins in the naphthas thus produced. The addition of 3 ml. per gal. of TEL to two typical motor gasolines of 10 lb. Reid vapor pressure improved antiknock quality to CFR-R octane numbers of 98.5 and 99.5, as follows:

Type of catalyst—	Natural—	
Cracking temperature	Moderate	High
Gas-oil conversion, per cent	54	61
A.S.T.M. octane number (no addition of TEL)	79.8	80.7
CFR-R octane number:		
Without addition of TEL	92.4	95.7
Plus 1.5 ml. TEL per gal.	97.0	98.0
Plus 3.0 ml. TEL per gal.	98.5	99.5

Increasing operations with synthetic catalyst, motor naphthas of higher than 100 CFR-R octane number (with 3 ml. TEL per gal.) have been produced in commercial fluid operations from both paraffinic and naphthenic-type feed stocks. Typical results on a light paraffinic gas oil are shown in Table 1. It is evident that high-quality motor fuels can be produced by fluid catalyst cracking.

The volatility of the motor fuels produced with cracking of the paraffinic gas oil increased with conversion levels, as did the A.P.I. gravity. Stability of the fluid catalytic naphthas was good, and no finishing treatment was required aside from a light caustic wash and the addition of an inhibitor. The heating-oil-fraction properties also vary with conversion—a somewhat lower A.P.I. gravity and a lower boiling stock resulting as conversion increases. The stock as produced is of excellent stability. Pour point of the heating oil as produced from the unit ranged from —10° to +10° F.

Plant throughput, during the period for which results have been presented, exceeded nominal design capacity by a substantial margin. As is indicated in Table 2, commercial yields, product quality, and operating conditions were in good agreement with those obtained in the semicommercial 100-bbl.-per-day pilot plant. Typical pilot-plant results on three feed stocks are presented in Table 3.

Although it has been demonstrated that the cracking of virgin gas oil to gasoline and other products in commercial operations can be carried out over a wide range of temperatures and conversion levels, the choice of the specific level to obtain optimum operations is dependent largely upon such economic considerations as the relative demand of heating oils and gasoline, availability of quantity and type of feed stocks, price structure, etc. With normal prewar demands for furnace oils, a yield of about 45 per cent of 10-lb. Reid vapor pressure motor gasoline was generally favored. However, with increased emphasis on maximizing motor-fuel production from raw material, it may become desirable to process further the gas oil unconverted in single-stage catalytic cracking. Experimental fluid cracking of virgin stocks, with internal recycling of the catalytic gas oil, for example, has yielded as high as 80 per cent of motor gasoline (100 per cent C_4) based on fresh feed. However, cracking of the cracked gas oil also can be accomplished thermally to yield 40 to 50 per cent motor fuel based on the feed to the thermal operation—the yield depending on the characteristics of the cracked gas oil.

Catalytically cracked gas oils are rather refractory toward further cracking, and tend to produce larger amounts of carbon and dry gas than virgin gas oils—thus resulting in reduced yields if operations proceed to

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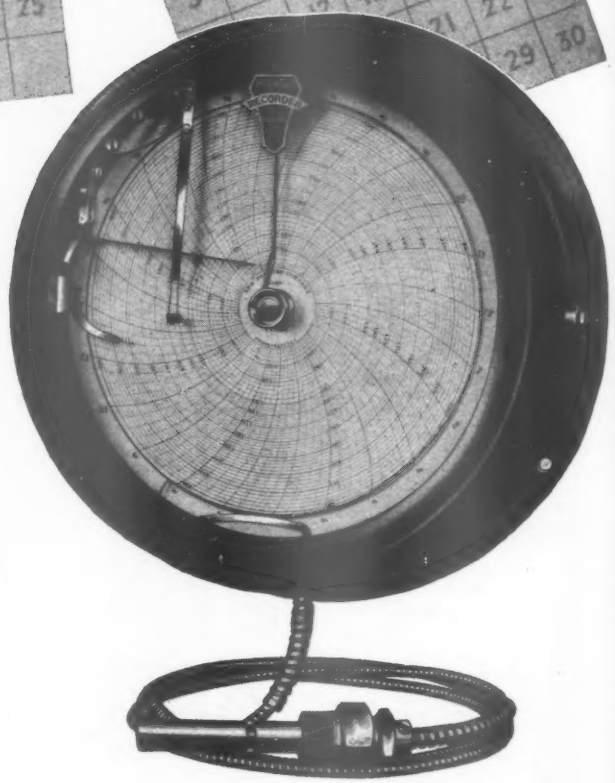

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ultimate gasoline yield. It has been found, however, that the undesirable constituents in the cracked gas oil can be eliminated by hydrogenation, with little or no gasoline formation and, consequently, with low hydrogen consumption, to produce a gas oil which is in most cases superior to virgin stocks in cracking quality. On the basis of experimental yields obtained from cracking and hydrogenation operations, it has been calculated that single-stage catalytic cracking, followed by ultimate-yield thermal processing of the cracked gas oil, would compare as follows with an ultimate-yield operation in which the cracked gas oil is lightly hydrogenated and then returned to catalytic cracking:

	Catalytic plus thermal cracking	Catalytic cracking plus hydrogenation
Yield on virgin feed (per cent by volume):		
Gasoline (10 lb. Reid vapor pressure)	63	92
Excess butane	5	13
Gasoline (100 per cent C_4)	68	105
Tar (12° A.P.I.)	30	..
A.S.T.M. octane No.	75	82

It will be noted that a large increase in yield on original gas oil is indicated through use of hydrogenation. Moreover, higher octane-number gasoline is produced, inasmuch as substantially all of the gasoline is of catalytic origin. Utilization of this technique should be of growing interest as petroleum reserves become more limited.

War-Products Operation

All commercial fluid plants now in operation are engaged in the production of war products. The fundamental difference between motor and war-products operations lies in the catalysts which govern the cracking reaction. The catalyst now in use in fluid plants producing war materials is a synthetic material which is particularly applicable to this type of operation. Due to the role that these operations are playing in supplying the nation's current military needs, only a general discussion of types of operation and qualities of products can be made at this time.

In cracking with synthetic catalyst, as with any other type, product distribution and naphtha composition are affected to a large extent by the type of feed stock charged, and by the temperature and depth of conversion at which cracking is carried out. The general effect of these variables when gas oils are processed is summarized as follows:

(a) **Temperature.** — Formation of saturated paraffins at a given conversion is favored by low temperatures. Aviation gasolines produced at the lower temperature levels are characteristically high in saturated isoparaffin content, but are low in aromatic concentration. High-temperature operations, on the other hand, lead to more highly unsaturated and, particularly, more aromatic fuels. Unsaturation in the butane and pentane fractions is affected similarly.

(b) **Conversion.**—Depth of cracking affects both yield and composition to a major degree. The higher conversions, at a given temperature, yield more highly aromatic and more saturated fuels.

(c) **Feed stock.** — Naphthenic feed stocks can be cracked to satisfactory yields of aviation gasoline which are generally of higher quality than those obtained from paraffinic stocks. With a given type of stock, boiling range also affects results—the lighter and more refractory stocks generally yielding products which are more saturated. It is to be mentioned that, regardless of the cracking conditions at which a naphtha is produced, further catalytic processing of this naphtha in subsequent and separate operations will result in further improvement in aviation-gasoline quality, largely through the elimination of olefinic compounds.

In applying catalytic cracking to the production of war products, therefore, optimum type of operations are determined by consideration of combined refinery operations, inasmuch as, for example, the production of raw materials for alkylation is of equal importance to the production of aviation-base stock itself. The flexibility of the fluid catalyst process permits choice of cracking operations over wide ranges of temperature, conversion, and feed stocks; and thus the operations which are most suitable to a particular refinery situation can be applied readily. With current aviation-fuel specifications and demands, single-pass high-temperature operations at moderate conversions appear optimum from a standpoint of utilizing most efficiently a given cracking capacity when cracking paraffinic-type stocks.

Aviation-Fuel Stock Characteristics

Characteristics of typical aviation-gasoline-base stocks produced over a rather wide range of conditions in commercial units are given in Table 4. It will be noted that the higher temperatures of operation give, before further treatment, a total aviation cut having somewhat poorer AFD*-1C antiknock quality than that produced in low-temperature cracking. This is due primarily to the more highly olefinic nature of the high-temperature stocks—which, however, are more aromatic. It is pertinent that the olefins in the catalytic naphthas are concentrated largely in the fraction boiling up to 225° F. In practice, therefore, this fraction generally is treated to remove olefins, whereby a superior-quality fuel is produced, or is discarded to motor fuel and re-

*Aviation Fuels Division.

TABLE 3—MOTOR-GASOLINE PRODUCTION AND QUALITY FROM FLUID CATALYTIC CRACKING OF GAS OILS

	East Texas wide cut	West Texas wide cut	West Texas heavy	Coastal wide cut
Feed properties:				
Gravity, °A.P.I.	31.7	27.3	22.3	22.1
Aniline point, °F.	180	169	171	180
Sulfur, per cent by weight	0.48	1.80	2.49	0.63
Product yields (per cent by volume):				
Motor gasoline*	45.0	43.2	46.0	46.2
Excess butane	4.3	3.0	2.0	4.0
Gasoline (100 per cent C_4)	49.3	46.2	48.0	50.2
Cracked gas oil	51.2	51.2	51.2	51.2
Dry gas, per cent by weight	4.3	6.3	5.6	5.4
Carbon deposit, per cent by weight	3.1	4.1	3.4	2.6
Motor-gasoline properties:†				
Gravity, °F.	60.5	58.2	58.2	57.0
Reid vapor pressure, lb.	10.0	10.0	10.0	10.0
A.S.T.M. distillation:				
Per cent distilled at:				
158° F.	25.5	18.5	18.5	23.0
212° F.	57.0	42.0	38.0	43.5
End point, °F.	406	400	401	406
Recovery, per cent	97.5	97.5	97.5	97.0
Aniline point, °F.	85	76	82	71
Sulfur, per cent by weight	0.03	0.18	0.246	0.044
Acid heat, °F.	159	162	186	180
Breakdown, hours	9	14.5	13	10
Octane No.:				
CFR-M:§ without addition of TEL‡	80.5	79.4	77.9	80.5
plus 1.5 ml. TEL gal.	84.6	83.0	81.2	84.7
CFR-R (1939): without addition or TEL	92.0	91.9	91.3	94.3
plus 1.5 ml. TEL per gal.	97.0	95.9	95.3	98.1
Cracked gas-oil properties:†				
Gravity, °A.P.I.	30.0	23.6	22.7	22.0
50 per cent point (A.S.T.M. distillation), °F.	572	605	605	563
Aniline point, °F.	144	129	124	96

*Reid vapor pressure, 10 lb.; end point, 400° F. †Inspections on product as produced without further treatment. ‡Tetraethyl lead. §Motor method.

placed by natural naphtha while the heavy highly aromatic naphtha in the 225° to 350° F. boiling range is blended directly into aviation naphtha. The production of raw material for alkylation is considerably higher in high-temperature cracking; and when overall aviation production is under consideration, cracking at these conditions is definitely superior to that at low levels.

Elimination of the olefinic constituents of the naphthas produced at high temperatures to improve AFD-1C antiknock quality may be accomplished in a number of ways. Two methods which have been utilized commercially are hydrogenation and catalytic treating. Results obtained from such processing are shown in Table 4, and it is apparent that final products of high antiknock quality (96.5-98.0 AFD-1C) result.

Severe Acid Treating

Another method is the application of severe acid treating, whereby comparable improvements may be obtained through removal of olefins by polymerization. Spent alkylation acid has been found to be suitable for this treatment. Inasmuch as most of the integrated aviation-gasoline operations use alkylation, the application of acid treating is of considerable interest.

Naphthenic stocks yield, in general, better quality aviation-base stocks than paraffinic feeds at comparable cracking conditions. Table 4 illustrates that extremely high-quality stocks can be produced when cracking proceeds at severe once-through conditions. Severe operations of this nature produce increased quantities of aromatics in the aviation-gasoline boiling range, and reduce at the same time the olefins which reduce AFD-1C antiknock quality.

Application of Fluid Cracking for Aviation-Gasoline Production in Combined Operations

To evaluate properly catalytic-cracking operations for production of aviation fuel, the process must be considered in combination with other refinery processes, particularly alkylation; because, in a broad sense, catalytic cracking is essentially a source of alkylate as well as of premium aviation-base material.

One application of fluid catalytic cracking in integrated refinery operations for aviation-fuel production is outlined in Fig. 4. This illustration is based on processing a typical heavy-paraffinic gas oil at high temperature; the butylenes and amylenes produced are alkylated with isobutane, and the light catalytic naphtha is severely acid-treated with sulfuric acid to improve AFD-1C antiknock quality by removing the olefins therein. The catalytic heavy aromatic fraction, which is high in antiknock quality as produced, is blended directly into the final gasoline. The blend of alkylate and naphthas from the catalytic operation is substantially higher in octane number than specifications require, and readily available virgin naphthas, which are of comparatively low quality, are blended in such quantity that the final blend will meet specifications—thereby increasing the volume of specification aviation product. In this scheme of operations, some isobutane is necessary to supplement the isobutane produced in catalytic cracking which supplies a quantity that is roughly sufficient to alkylate only the butylenes. Normal butane, which is generally available, is isomerized readily to isobutane in relatively simple and inexpensive equipment.

The yield of aviation gasoline resulting from the combination of processes discussed (Fig. 4) is quite high. For every 100 bbl. of heavy paraffinic gas oil charged to the fluid catalyst unit, it is possible to produce 66.3 bbl. of 100-octane-number aviation fuel meeting present specifications. Of this quantity, 12.2 bbl. are virgin-naphtha fractions which can be carried in the blend. A substantially higher yield of aviation gasoline can be obtained by hydrogenating, rather than acid-treating, the light catalytic naphtha. Production of specification

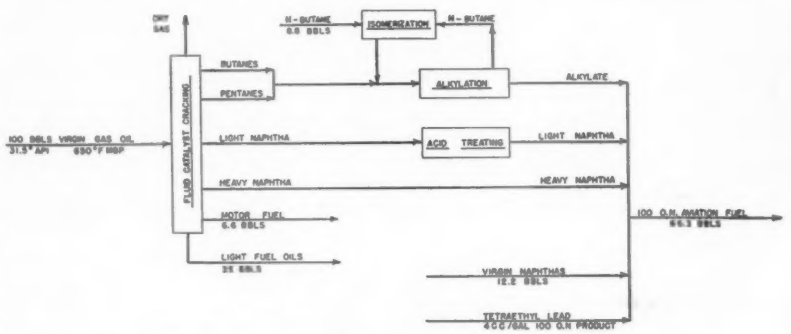

Fig. 4: Aviation gasoline by fluid catalyst cracking

TABLE 4—TYPICAL PRODUCT QUALITY OF CATALYTIC AVIATION-BASE STOCKS—COMMERCIAL OPERATIONS—SYNTHETIC CATALYST

Type of operation—	Paraffinic feed stocks				Naphthenic feed		
	Single-stage			Two stage	Single-stage		
Temperature level—	Low	High	Hydrogenation*	High	Low	High	High
Feed stock (gravity, °A.P.I.)	36.7	36.1	36.1	30.5	33.8	29.6	29.6
Gas-oil conversion, per cent	52.7	64.0	64.0	60.0	56.6	63.5	81.3
Reid vapor pressure, lb.	7.0	7.0	6.8	7.0	7.0	6.9	6.9
Gravity, °A.P.I.	61.5	56.4	58.2	57.8	57.7	55.8	51.3
Aniline point, °F.	92	45	84	69	75	†34	†24
Acid heat, °F.	56	135	6	36	44	†144	†100
Bromine No., centigrams per gram	22	64	0	12	22	†45	†22
Sulfur, per cent by weight	0.02	0.03	...	0.03	0.03	†0.03	†0.03
A.S.T.M. distillation:							
Per cent by volume over at:							
167° F.	33.5	34.5	28.5	31.0	29.0	28.5	24.0
221° F.	61.0	56.5	54.0	55.0	53.0	55.5	46.5
275° F.	84.5	80.0	81.5	77.0	77.5	85.0	75.0
293° F.	91.0	90.0	91.0	90.0	88.5	92.7	91.4
End point, °F.	332	322	318	318	326	319	320
Octane No.:							
A.S.T.M.: without addition of TEL	81.0	83.7	80.4	83.2	81.7	†81.7	†86.0
AFD-1C: plus 4 ml. TEL per gal.	93.3	91.7	98.2	96.5	94.9	†92.6	†97.4

*Shows high-temperature gasoline from Column 2 after hydrogenation. †Inspected on pentane-free basis. ‡Rated with pentanes added for 7 lb. Reid vapor pressure.

aviation fuel from such a scheme of operation is indicated to be 78.4 bbl. per 100 bbl. of paraffinic virgin gas oil charged to cracking.

With the completion of the present construction program, the fluid catalyst process will be the major cracking process for producing 100-octane aviation gasoline. On resumption of normal economic conditions after the war, the fluid process will provide a means of converting the heavier petroleum fractions with maximum efficiency and economy into premium motor fuels.

Acknowledgment

The fluid catalyst process represents a contribution of the Standard Oil Development Co. to a cooperative study on catalytic refining participated in by the refining organizations of Standard Oil Co. of New Jersey, and by Anglo-Iranian Oil Co., Ltd., M. W. Kellogg Co., Shell Oil Co., Inc., Standard Oil Co. (Indiana), Texas Co., and Universal Oil Products Co.

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HOUSTON 1, TEXAS

Methods Used by Magnolia Pipe Line To Combat Internal Corrosion

*by H. M. Stevenson**

HUMBLE Pipe Line Co.'s system as originally designed was an 8-in. pipe line constructed from a point near London (Rusk County) in the East Texas field, to the Baytown refinery of Humble Oil & Refining Co. located on the Houston ship channel in Harris County. The primary purpose of the system was to provide an outlet for the natural gasoline from a number of plants in the field and to transport same to the Baytown refinery.

The system went into operation in July 1936 and has since been augmented by lateral extensions to other fields—namely, Conroe, Tomball, and Katy, all interconnecting with the 8-in. main line at Satsuma station.

Materials pumped.—The materials transported through the system consist of mixtures of light hydrocarbons run from the various natural-gasoline plants in East Texas and other fields to which the system is connected.

For 1½ to 2 years after the line started operation, mixtures varying quite widely were transported; however, over the past 5 years, analyses made at Baytown have shown that the stream remains more or less constant.

Table 1 gives an average analysis of the composite stream now received at Baytown.

TABLE 1
HYDROCARBON ANALYSIS

	Per cent (by volume)
Propane	6.7
Butane	56.4
Pentane	18.7
Hexane and heavier	18.2
Total	100.0

Note: The stream contains traces of ethane.

The gravity of the materials handled varies from 100 to 110 A.P.I. at 60° F. with an average Reid vapor pressure of between 55 and 60 lb. at 100° F. The system is operated continuously with no attempt made to segregate or batch streams from the various plants being served. On the contrary, to meet the refnery requirements at Baytown, uniformity must be maintained as far as possible both as to the hourly rate of pumping and composition of stream inasmuch as the pipe-line system makes its deliveries into the fractionating units of the refinery.

*Humble Pipe Line Co.

A.P.I.

This paper was one of several contributed to a "Symposium on Combating Internal Corrosion of Products Pipe Lines" before the A.P.I. Division of Production, Chicago, Ill., November 8-11.

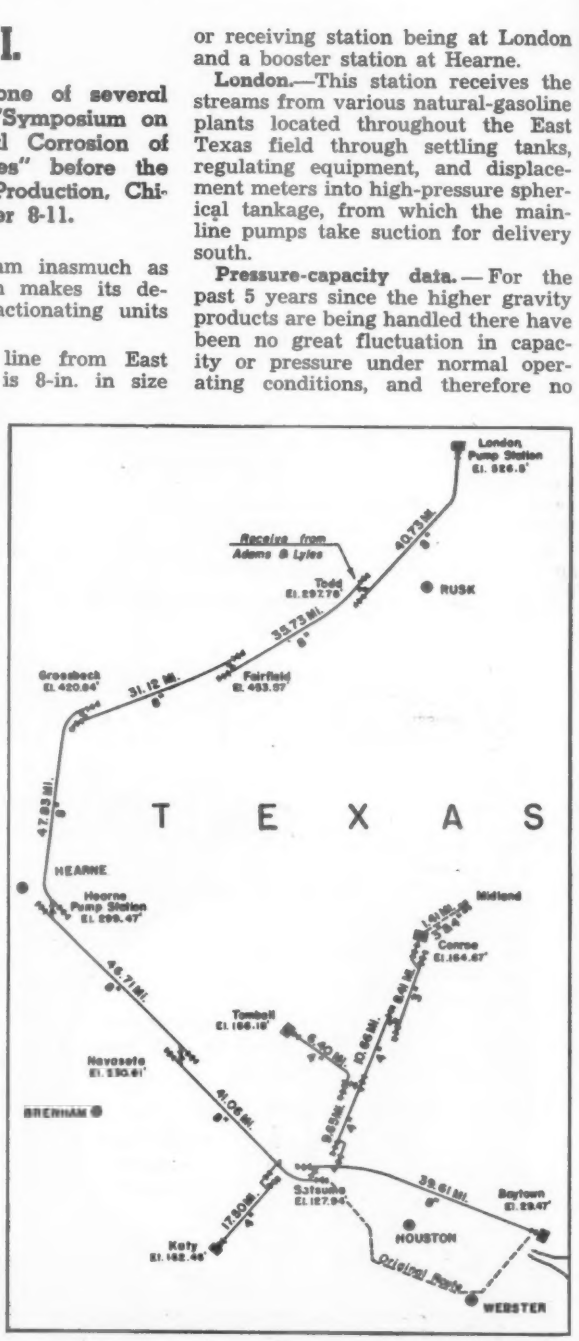
Line.—The main line from East Texas to Baytown and is of standard line-pipe weight. Of the 282.79 miles of pipe in the system, 62.86 miles was new seamless welded pipe, 121.51 miles welded pipe previously in oil service, and the remaining 98.42 miles was screw-end pipe previously in oil service but with collars welded before conversion to gasoline service.

Of the screw-end pipe 87.77 miles is between Hearne and Satsuma station and had been in the main crude-oil trunk system a number of years handling sour crudes from West Texas and Panhandle areas. The lateral lines entering the main line at Satsuma from Conroe, Tomball, and Katy fields are 4 in. except for a small amount of 3 in. from the Conroe pumping plant to the junction of the line from Tomball.

On the main line from East Texas to Baytown are located two pumping stations, the initial or receiving station being at London and a booster station at Hearne.

London.—This station receives the streams from various natural-gasoline plants located throughout the East Texas field through settling tanks, regulating equipment, and displacement meters into high-pressure spherical tankage, from which the main-line pumps take suction for delivery south.

Pressure-capacity data.—For the past 5 years since the higher gravity products are being handled there have been no great fluctuation in capacity or pressure under normal operating conditions, and therefore no



Humble Pipe Line Co. natural-gasoline pipe-line system

great amount of detailed study has been made on the hydraulics of this system due to the more or less constant flow and pressure. Since line went into operation in 1936 there have been certain changes in physical layout of system as well as materials handled, and therefore direct comparisons between original design and present-day actual operation cannot be made. However, given below is a brief outline as to the original design as well as actual operations.

(a) The original design of the 8-in. line from East Texas was started late in 1936 and was based on data secured from the gasoline and refining department of Humble Oil & Refining Co. for use in hydraulic calculations, which data showed that the material handled would have a gravity range from 80° to 85° A.P.I. at 60° F., and a viscosity estimated of 35 Saybolt seconds maximum with a Reid vapor pressure of approximately 26 lb. at 100° F. These data were the best available at that time in view of the fact that a number of the natural-gasoline plants in the East Texas field were either not completed or had not been equipped to produce large quantities of the lighter hydrocarbons such as butanes and propane.

Since it was proposed that the 8-in. gasoline line would follow the right-of-way of the company's existing crude system for East Texas to Baytown and any proposed intermediate stations on the line would be located at existing crude-oil stations, the question of line hydraulics was to find the maximum capacity of the system operating at 700 lb. per sq. in. at the initial station with 75 lb. per sq. in. back pressure on the receiving station. The 75-lb. back pressure would not, of course, be necessary if the vapor pressure of materials to be handled were not over the 26 pounds as above referred to. However, in all of our studies of this system it was felt that some day after the line had gone in operation the pipe line would be called upon to transport materials of much higher vapor pressure. This has proved to be the case.

For instance, the line actually started handling 18-lb. material, then was increased to 26 lb., and as additional equipment was installed in the gasoline plants in East Texas larger quantities of butanes and propane were produced and within 1 and 1½ years the gravity of the stream had increased to approximately 95 A.P.I. with an increase in vapor pressure averaging 45 to 50 lb. Reid.

Within 2 years after the line went into operation the materials had further increased in gravity ranging from 100 to 110 A.P.I. at 60° with an attendant increase in vapor pressure to between 55 and 60 lb. Reid. Since that time the gravity and vapor pressure of the average stream has remained more or less constant as reflected by Table 1.

With the data originally given us as to the proposed specifications of the materials to be handled, a design of the line was made by using Durand's formula for calculation of capacity and pressure drop. These calculations showed that our capacity would be 12,500 bbl. per day from London to Hearne. Since the line between London and Baytown has been shortened by approximately 22 miles from the initial system, original design figures will therefore not apply to present system.

For the past 5 years, or since the higher-gravity materials are being handled, our capacity from London to Hearne with 700 lb. pressure at London and 60 lb. pressure on the suction at Hearne is 16,000 bbl. per day, or by the present system London to Baytown without Hearne boosting and maintaining 95 lb. on the meters at Baytown, our capacity with 700 lb. at London is 12,500 bbl. per day.

It should be pointed out at this time that the analyses show the materials being handled are considerably lighter than those on which the original design was based, and as a matter of general information I am submitting Table 2 attached which shows the operation of the line from actual test runs made in October this year both before and after scrapers were run through the entire line from London to Baytown.

(b) As has been pointed out, during 5 to 6 years actual operation no great variation in capacity and pressure has been observed, but it has been our practice to check periodically by means of the Hazen and Williams formula the capacities and pressures on the line to be sure no material corrosion or stoppage is present in the system and that the operating data being recorded daily by our dispatchers is within a reasonable degree of accuracy.

It can be stated also that the data shown on Table 2 so far as pumping rates per hour and pressures are concerned represent normal operating conditions which have been in effect for several years.

(c) Table 3 shows the average daily throughput by years since the line started operation.

Means of Combating Corrosion

(a) **Extent of internal corrosion.**—During the 7 years operation of this system little evidence of internal corrosion has been observed. No appreciable increase in pressure drop or decrease in capacity has been apparent, and the amount of scale caught by the strainers has been quite small. We have been repeatedly assured that the materials delivered into this system by the natural-gasoline plants were free from water and oxygen and frequent check analyses at Baytown refinery have borne out this claim.

Since the average load factor of the main line varies from 70 to 75 per cent and uniform throughput is desired at Baytown, it is difficult to conduct any tests at maximum capacity rates for a continuous period from which data can be obtained to indicate exact physical changes in the

TABLE 3—AVERAGE DAILY THROUGHPUT BY YEARS

Year	Delivered by London	Received by Baytown*	Remarks
1936 (From July 7)	3,961	4,145	Conroe started Aug. 1936
37	10,181	10,776	Tomball started Aug. 1937
38	11,548	12,613	
39	12,088	13,321	Midland started Sept. 1939
40	10,561	12,019	
41	10,648	11,927	
42	9,506	10,820	Todd started Oct. 1942
43 (To Aug. 31)	10,072	11,705	Katy started July 1943

*Receipts at Baytown include streams from Conroe, Tomball, Midland and Katy injected at Satsuma.

TABLE 2—PRESSURE-CAPACITY TEST BEFORE AND AFTER SCRAPERS WERE RUN OCTOBER 1943

	Bbl./Hr. at line temp.	Pressure Line	Pressure Static	Pressure Dely.	Pressure Net	Total miles	Temp. °F. avg.	Grav. °A.P.I. at 60° F.	Pressure drop per mile lb./sq. in.	Roughness factor C*
LONDON-BAYTOWN										
Before using scraper	500	672	144	95	721	282.79	76	106	2.55	155.29
After using scraper	523	678	144	90	723	282.79	77	100	2.59	163.40
LONDON-HEARNE										
Before using scraper	657	628	66	60	634	155.41	76	106	4.06	158.37
After using scraper	658	630	66	60	636	155.41	77	100	4.09	160.55
HEARNE-BAYTOWN										
Before using scraper	657	597	78	94	581	127.38	76	106	4.56	149.18
After using scraper	658	540	78	90	528	127.38	77	104	4.15	158.73

*Hazen and Williams formula.

condition of the interior of the pipe.

It is our opinion that internal corrosion of our London-Baytown 8-in. line is negligible. The conditions on the 3-in. and 4-in. lines entering the main system at Satsuma have not been fully investigated, and there is a possibility that some internal corrosion is being experienced on these lines. A thorough investigation of the condition of these lines is to be conducted in the near future.

(b) **Measures taken to reduce or retard interior corrosion.**—No preventive measures such as the introduction of chemical corrosion inhibitors into the line have been necessary. Settling tanks are used to remove any water from the gasoline before it enters the line. The removal of entrained water is desirable even if the question of internal corrosion of the pipe were not involved.

Scraper traps were only installed at London, Hearne, and Baytown at the time the line was constructed. Later, however, other companies began to report execessive internal corrosion on their systems, and we decided to install additional traps along our system to further facilitate running of scrapers in order to remove any water or corrosion products that might exist.

(c) **Methods used in cleaning or scraping the line and results obtained.**—No regular cleaning or scraping of the line has been required; therefore, few scrapers have been run. Scrapers were run through all lines in 1939 and only a small amount of scale was removed.

Regular pipe-line scrapers equipped with neoprene disks and knives were run during October of this year for the first time since 1939. As a result, 35 lb. of scale was removed at Hearne from the 155.41-mile London-Hearne section, and 945 lb. was removed at Baytown from the 127.58-mile Hearne-Baytown section. Negligible quantities of scale were removed at the intermediate scraper traps as it was carried with the stream to the Hay tanks and strainers at terminal stations.

It became evident during the running of these scrapers that the pipe between Hearne and Baytown was much rougher internally than that between London and Hearne, since only one scraper was used in each section between London and Hearne with no trouble experienced with its travel through the line, whereas in the three sections from Hearne to Baytown the first scraper encountered rough going, and as a consequence the second scraper was necessary in each of these three sections to force the first scraper through.

We believe that the apparent roughness and the larger amount of scale removed at Baytown can be explained by the fact that the line south of Hearne is made up of a large amount of screw-end pipe which had been in sour crude oil service for several years prior to its conversion to natural gasoline service. Other companies report the most severe corrosion near the input end of the line, but it appears that we may safely say that the corrosion in the first 155 miles of our line out of London is negligible.

Table 2 shows the results of the pumping tests before and after running of the scrapers as reported above, and it will be noted that the removal of approximately 1,000 lb. of scale from the line had little effect on its capacity.

(d) **Measurement of rate of corrosion.**—No test specimens have been used as we have not considered it necessary to cut out sections of the pipe for examination.

(e) **Cause of interior corrosion.**—It is believed that the material pumped is practically free from corrosive elements.

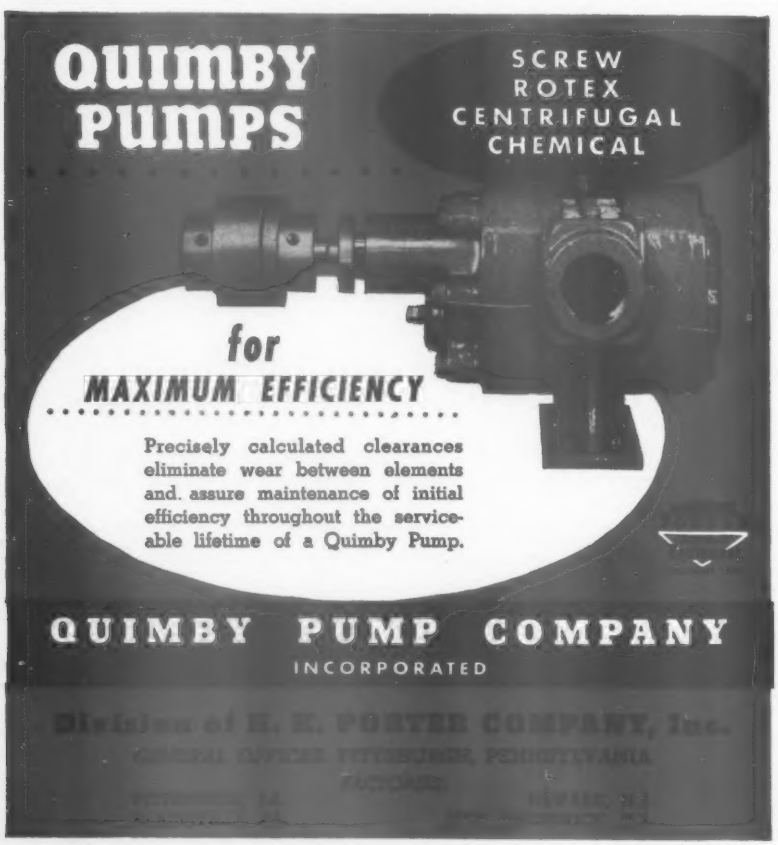
(f) **Amount of water in line.**—No evidence of water in the line has been observed since it was cleared of that used in hydrostatic tests at the start of operations. The stabilizing operation at the gasoline plants is believed to effectively remove all water. Occasional small slugs of water are received at London but are separated by settling before entering the spheres. The low specific gravity of the material facilitates settling of the water. No water was found during the recent running of scrapers, and none is normally received at Baytown.

(g) **Amount of oxygen in the gasoline.**—The type of equipment in the natural-gasoline plants is believed to remove oxygen as well as water from the gasoline.

(h) **General comment.**—Since we have had so little trouble with internal corrosion of our natural-gasoline system, it has not been necessary for us to change our operating procedures because of it. A small amount of extremely fine scale which we attribute to the pulverizing of loose scale in the line by attrition has given some trouble with the metering equipment. The installation of felt or cloth filters several years ago was necessary to protect the meters from this scale.

Whenever it becomes necessary to cut or repair any of our lines, Mueller tapping and plugging equipment is used so that it will not be necessary to displace the line with water.

Within the last few months when the Katy 4-in. line was put into service, the line was hydrostatically tested with water, and in displacing the water with natural gasoline into Satsuma, a small amount of water entered the main line and evidence of rust was observed at Baytown which was of short duration.



QUESTIONS on TECHNOLOGY

by W. L. Nelson

Identification of Additives In Aircraft Oils

We want to know what compounds are and could be used as additives (antioxidants) to lubricating oils, also how are additives separated from the oil and identified? It seems that some of the lubricating oil used here by the Air Corps is damaging the engines.— Lt. R.A.H.

It is not altogether certain that oils with additives in them are unsuitable for aircraft engines. Some refiners say that detergency-type additives should not be used in aircraft oils, but other authorities, who, by their connections with government contracts, should know whereof they speak, say that none of the additive materials accepted by the government can harm aircraft engines.

The main type of additive materials are:

1. **Pour-point depressants.** — Illustrated by chlorinated paraffin wax containing some of a chlorinated naphthelene derivative.

2. **Viscosity index improvers.** — Illustrated by butene polymers.

3. **Oiliness agents.** — Illustrated by dibenzyl disulfide, or by sulfur-chloride treated materials.

4. **Detergency agents.** — Illustrated by calcium soaps or dichlorstearic acid.

5. **Antioxidants.**—Such as tributylphosphate mixed with several parts of tricresyl phosphate.

Unfortunately, a large number of additives have been proposed or used for each of the additive types listed, and hence, a suitable analysis method would be extremely complicated and of doubtful accuracy. If the names of the particular agents being accepted in military oils were made public it would be possible to devise a comprehensive analysis method.

There are, however, certain tests or properties, that may be of some value. Some of them are:

1. Color—Additive oils have darker colors than straight mineral oils.

2. Launderometer test (S.A.E. Journal page 309, August 1941)—This test is said to definitely identify oils which contain detergency additives. The test is conducted by dipping two pieces of white cloth, preferably flannel, in a mix of 30 grams of lampblack in 450 cc. of cleaners' naphtha. The dirty cloths are then washed in a 50-50 mixture of oil and naphtha, one in a straight mineral-oil mixture and the other in the unknown oil mixture. Detergency oils will clean the dirty cloth to an unmistakable, although not clean, degree.

3. Odor—The odor of most of those oils which contain additives is definitely different from the odor of straight mineral oils. It is best to determine odor by comparison with the odors of known oils.

4. Ash content — Straight mineral oils and the sulfur-chlorine oiliness type of oils usually contain less than 0.03 per cent ash, whereas the detergency (and antioxidant) oils usually contain in excess of 0.25 per cent ash.

5. Corrosion test—The dibenzyl disulfide hypoid gear lubricants, a common type, are not corrosive by the regular 212° F. copper strip test but they are corrosive when the test is conducted at 300° F.

6. Ash analysis—Such an analysis tells much about the type of additive being employed as against plain metal soap additives. Such elements as calcium, phosphorus, zinc, barium, chlorine and sulfur can be determined with relative ease.

7. Bomb (peroxide or oxygen)—May be used to determine sulfur, chlorine and phosphorus by regular analysis methods.

8. Bielstive flame test — Identifies chlorine, bromine, or iodine by the green flame discoloration produced by a clean copper wire which has been dipped into the oil.

These methods are not satisfactory unless the man who conducts them has had experience with and is familiar with the particular additive oils that may be encountered.

More general information about additives may be gained from the following pages of questions on technology in The Oil and Gas Journal:

Viscosity index—October 15, 1942, page 50.
Paraflow—July 30, 1942, page 168.
Kinds of—March 27, 1941, page 208.
References to—September 4, 1941, page 60.

Launderometer Test For Diesel Oils

What is the Launderometer test which is used with detergency oils?— F.E.R.

The exact source or origin of the Launderometer test, or when this term was first used, is unknown to our department. Bray, Moore and Merrill (Improvements in Diesel-Engine Lubricating Oils, S.A.E. Trans. Jan. 1939, p. 35) recognized the laundering action of certain oils on engine mechanisms. McNab, Winning, Baldwin and Miller (Lubrication of Severe-Duty Engines—Diesels, S.A.E. Journal, Trans., Aug. 1941, pp. 309-325) show pieces of cloth which have been dirtied with lampblack and then washed with naphtha or additive oil. Perhaps they are the originators of what refiners often call the Launderometer test.

The test has probably not been formally adopted or specified by any societies but it is well known. One method of conducting the test is to soil pieces of white flannel cloth in lampblack, suspended in cleaners' naphtha. The pieces of soiled cloth are then washed in the oils being tested. The oils are usually diluted 50:50 with cleaners' naphtha to facilitate the washing. Finally, the cloths are rinsed several times in cleaners' naphtha. It is best to use the test as a comparison of the cleaning properties of various oils, that is, to use a straight mineral oil of paraffin-base origin and a good detergency (additive) oil as blanks. The detergency oil will markedly clean the cloth but the straight paraffin oil will leave lampblack in the cloth.

Even the best detergency oils will not completely clean the cloth. Lubricating oils of naphthene-base origin show some detergency action, but most of the so-called detergency-type diesel oils are made by adding a detergent - dispenser - inhibitor additive to a mixed-base or paraffin-base stock.

Oil-Well Pumping Practices—No. 18

Factors Governing Selection Of Prime Mover

by J. Zaba

In the immeditely preceding installment, the author discussed in a general way the subject of prime movers. Here, he continues the discussion, and points out some considerations in determining the particular types of prime mover best suited to particular applications.

ONCE power requirements of a sucker-rod pumping installation have been determined, the next question is selection of the type of the prime mover to be used. The selection, as far as oil-well pumping is concerned, is between internal-combustion engines and electric motors. The decision whether to use electric power or internal-combustion engines must be based on careful consideration of a large number of factors. Of these factors, the availability of source of power would appear to be the primary consideration. In most oil fields the natural gas is available and in large number of them there is no readily available market for gas. Because of this fact, gas engines, single-cylinder slow-speed or multicylinder high-speed gas engines, suggest themselves as a logical selection. Actually, however, other factors are of equal, if not more pronounced, importance. These factors include characteristics of prime movers and of loads and the total of all the costs involved.

From the standpoint of the prime mover itself, the cost of investment and maintenance, the efficiency of converting the energy into developed power,[1] the availability of field personnel familiar with given types of prime movers, availability of repair facilities, all have to be weighed against each other. Analysis of costs and loads includes many factors. If gas engines are under consideration, a study must be made of type of gas available, whether it is sweet or sour. Possible future cost of gas must be considered. Available gas reserves are important. In a new field, gas is usually abundant. During the later stages of the producing life of the field, however, gas may not be available and later conversion to the electric power, representing second capital investment in cost of production may prove uneconomical. Cost of gas gathering and distributing system must be included in calculations of the investment, and cost of maintenance of the system in the operating expense. In many cases, the type of available water may have a bearing on the problem. If a circulating cooling system is to be used, the possibility of cost of treatment of water must not be disregarded. Similar considerations must be applied to decision on selection of oil engines. That means the type of oil available, cost of transportation, and market value of oil and question of water supply. In case of electric power the initial cost of distribution system, the terms of contract and cost of power, maintenance cost of the system, types of loads encountered, all have to be analyzed.[2] Once electric power has been decided upon, further selection must be made between use of utility power and of private generating plant. To arrive at such decision the original cost of private generating plant and its operating cost, particularly that of fuel, have to be compared with cost of bringing the utility power to the lease and actual cost of utility power. Questions of future increase in power demand, because of increase in water content of the produced fluid, probable life of the field, spacing of wells[3] are also important factors.

Function of Prime Mover

Summary, given above, of the most important factors affecting selection of the type of prime mover to be used, makes it quite apparent that no general comparison can be made between internal-combustion engines and electric motors as prime movers of pumping installations. Available data on comparative tests hold true only for given sets of conditions and any attempt on generalization of such data would lead to erroneous conclusions. This statement holds true both in regard to cost comparisons and in regard to discussion of comparative operational characteristics of the two types of prime movers in their role of powering the pumping installations.

With development of portable well-servicing units, the only function of the prime mover of a pumping installation is to supply power necessary for pumping. This fact had important bearings on evolution of types of prime movers, both internal-combustion engines and electric motors employed in powering unit pumping installations. A modern power unit of such an installation is small and compact, and possesses characteristics required for efficient handling of type of loads involved.

Detailed discussion of the different types of internal-combustion engines and of electric motors, used as prime movers of unit pumping installations, is beyond the scope of this series. Within the framework of this article it is possible to mention only their most general characteristics, selecting those which are of particular interest to the operator of the prime mover. The interest of the operator in a prime mover is centered mainly on the prime mover's satisfactory and efficient performance. Field practices leading toward attaining of such performance must be based on the knowledge of basic principles underlying operation of prime movers and of problems encountered in their application. The following summary reviews some of the fundamentals of these two subjects. References given cover the subject of prime movers from the standpoint of oil-field practice application. For more detailed study, different engineering handbooks and testbooks must be referred to.

Internal-Combustion Engines

The internal-combustion engines convert the energy of combustion of fuel with air, occurring within the cylinder of the engine, into the useful mechanical work. They may be divided into several groups depending on the kind of fuel used, on the thermodynamics of the cycle of operation and on the number of strokes the cycle is acomplished in.

Types of engines.—From the standpoint of fuel used, the internal-combustion engines may be divided into liquid-fuel and gaseous-fuel engines. In the field of oil-well pumping, the gaseous-fuel engines, using natural gas as fuel are probably predominant.

From the standpoint of thermodynamics of cycle of operation the internal-combustion engines can be divided into following groups: (1) The Otto cycle group, in which fuel and air are mixed in the proper ratio before they enter the cylinder of the engine. The cycle consists of four operations: charging of the cylinder with fuel-air mixture, compression of the mixture, ignition of the mixture resulting in the power stroke, and

discharge of product of combustion. Natural-gas, gasoline and butane engines utilize the Otto cycle in which combustion occurs at constant volume. (2) The second group is the diesel cycle group. In this cycle only air is drawn into the cylinder during the charging stroke. During the compression stroke, the temperature of the air, compressed to around 500 lb., increases to around 1,000° F. Just before the end of the compression stroke, fuel oil is injected under pressure into the cylinder, is vaporized and ignited. Combustion takes place at a constant pressure. Following the power stroke the products of combustion are ejected on the return stroke. (3) The third group is the mixed cycle engine group, with air compressed in cylinder and fuel injected under pressure. The compression of air is not carried far enough to furnish temperature needed for ignition, and ignition is brought about by injecting the fuel against some uncooled portion of cylinder. Spark plugs and timed system of electric ignition are also employed.

From the standpoint of number of strokes of the piston during which the cycle of operation occurs the engines may be divided into four-cycle (four-stroke cycle) and two-cycle (two-stroke cycle) engines. In case of the four-cycle engine each of the four elements of the cycle occurs during one of the strokes of the piston. In case of two-cycle engines the four elements of the cycle occur in two strokes of the piston.

Mechanical efficiency.—The ratio of the brake horsepower to the indicated horsepower is the mechanical efficiency of the engine. The indicated horsepower of the engine can be determined from the formula:

$$HP_i = \frac{PALE}{33{,}000} \times \text{number of cylinders}$$

where

HP_i = indicated horsepower
P = mean effective pressure, lb.
A = area of piston, sq. in.
L = length of stroke, ft.
E = number of explosions per minute in each cylinder

The mean effective pressure can be obtained from an indicator card.

The brake horsepower is the actual useful work which the engine is capable of delivering and is calculated, by employing Prony brake and by use of the formula:

$$HP_{Br} = \frac{2\pi L W N}{33{,}000}$$

where

HP_{Br} = brake horsepower
L = length of Prony brake arm, ft.
W = load on the brake arm, lb.
N = number of engine revolutions per minute.

Rating.—Selection and rating of internal-combustion engines will be considered in one of the later installments, together with rating of other component parts of surface pumping equipment.

Gas engines.—Of all the internal-combustion engines, the gas engine is probably one most commonly employed as a prime mover of the unit pumping installations. Fuel requirement of gas engines depend on degree of loading and are shown in Table 1 for natural gas having a heating value of 1,100 B.t.u. per cu. ft.[4]

Proper care in operation of gas engines should include attention to maintaining, in satisfactory order, of ignition, carburetion, lubrication and cooling systems.[5] While all of them contribute, of course, toward efficient working of the engine, the question of carburetion and cooling present, quite often, a special problem under oil-field-service conditions. The supply of gas to the engine must be clean. Presence in gas of foreign matter, such as water, is cause of frequent troubles. Use of scrubbers is quite general and frequent blowing down of scrubbers is essential. The delivery pressure to the carburetor has to be constant and maintaining of pressure regulators in good state of repair must be attended to. Air cleaners have to be cleaned and serviced at proper time intervals. Proper air-gas ratio of the mixture for gases with different heat contents must be determined and maintained. The cooling of the engine is of particular importance, since the operation of the cooling system affects the efficiency of operation of the whole engine. There are many problems connected with question of cooling.[6] From the standpoint of operator, the problem of water, used in cooling, is probably the most important one. Questions of scale deposits, oxidation and corrosion are encountered and have to be met in every day's operations. The comparatively new, that is new as far as oil-field practice is concerned, "vapor phase" system of cooling has already proved its merit.[6]

Electric Motors

An electric motor is a machine which converts, with high degree of efficiency, electric energy into useful, mechanical work. Depending on the type of current used, the electric motors are divided into two basic groups, alternating-current motors and direct-current motors. Only alternating-current motors need be considered here.

The alternating-current motors may be of the synchronous or induction type, either of which may be single phase or polyphase. The induction-type motors are divided into two classes, the squirrel-cage and wound-rotor types.

The speed-torque characteristics of an electric motor determine its ability to meet specific requirements of a given application. The alternating-current, squirrel-cage induction motor possesses characteristics which make it especially adaptable as a prime mover of unit pumping installations. Of several types of squirrel-cage motors now available, the following are used for powering of pumping installations:[4] (1) Normal torque, normal starting current; (2) high torque, low starting current; (3) high slip; (4) medium slip. The high torque, high slip and medium slip motors are all characterized by high starting torques, although they differ in efficiency, starting current requirements and other characteristics. The term "slip" expressed in per cent, refers to the decrease in speed of the motor from the no-load speed to the speed with the connected full load.[7]

The efficiency curve of an electric motor shows that good economy of power is secured somewhere between half load and full load.[7,8,9] Within this range the efficiency varies only very little. Below the 50 per cent loading, however, the efficiency drops very rapidly. To secure good utilization of the energy therefore, proper-size motors should be selected so that they operate close to their full-load rating. As in case of internal-combustion engines, the question of selection and rating of electric motors will be considered later, together with discussion of rating of the surface equipment of a pumping installation.

Use of electric motors permits two operational practices which are of importance in efficient handling of a pumping installation. The amount of actual power supplied to the installation can be easily and accurately determined. This permits quite accurate calculations of efficiencies and costs. Counterbalance conditions of a pumping well powered with an electric motor can be determined conveniently without interfering with the well's operation.

Proper maintenance and care of electric motors consists of attention

(Continued on page 56)

TABLE 1—FUEL REQUIREMENTS OF GAS ENGINES

Per cent of maximum horsepower	80	75	70	65	60	55	50	45	40	35	30
Cubic feet per horsepower-hour	10.5	10.7	10.9	11.3	11.6	12.0	12.5	13.2	14.0	15.0	16.0

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Maintenance Program for Compressor-Plant Operators

*by L. F. Scheel**

THE air or gas compressor has had a minor application in an oil refinery. It was used for operating pneumatic tools, controls, air-blown asphalt stills and perhaps a refrigeration or Edeleanu plant. This was prior to the demand for large quantities of high-octane fuel from the various new catalytic cracking processes. The modern refinery is now equipped with several thousand horsepower of compressors. The maintenance of such large plants is new to the refiner and has undoubtedly presented problems of a different order than those to which he has been accustomed.

We, in the natural-gasoline industry have nurtured the heavy-duty gasoline-engine-driven compressor for a score of years. Perhaps we have encountered problems that refiners have met or may meet.

Fuel Supply

The natural gas supplied by the public utilities is the best fuel source. A constant quality of dry clean gas is desirable with the propane and heavier fractions limited to 13 per cent or 1,300 B.t.u. (gross) per cubic foot. It has been with reluctance that occasionally we have had to use stabilizer waste gas blended with the dry engine fuel. This practice usually results in "rough" operation or engine detonation and may eventually influence the piston and bearing repair.

A constant fuel pressure is necessary to insure a uniform mixture over the full operating range. The purpose of the four-cycle engine's sensitive fuel regulator, or a gasometer, is to maintain a constant pressure of 1 in. of water. Pressure variations in the 8-oz. fuel header will make this operation less responsive. For this reason, it is preferable to use one large pilot-operated reducing regulator rather than small individual less active regulators.

Year in and year out fuel consumption will average 10.5 cu. ft. per brake horsepower hour of 1,300 B.t.u. (gross) per cu. ft. gas at 100 per cent load factor; 11.8 cu. ft. at 80 per cent load; 14 cu. ft. at 60 per cent load. The fuel rate will hold for both four-cycle and two-cycle injection engines. Under test conditions we have always met the manufacturer's usual guarantee of 10,000 B.t.u. (net) per brake horsepower hour.

*Production foreman, Union Oil Co., Santa Fe Springs, Calif. Paper presented at eighteenth annual fall meeting of California Natural Gasoline Association, Biltmore Hotel, Los Angeles, Nov. 5, 1943.

Ignition System

A low-tension magneto, with a rotating field and the high-tension coil at each spark plug, is the ultimate for ignition purposes. This type minimizes the corona loss that exists in transmitting the high-tension spark 12 ft. on the modern angle-type unit. It also prolongs spark-plug life. The next best selection is the rotating high-tension magneto. The oscillating-type magneto is passe. Positive timing over long periods was impossible because of wear of the trip finger.

The desirable type of spark plug has a "cold body," a heavy center electrode and multiple-body electrodes. The greater electrode surface gives longer firing life. A good operator will set the electrode clearance at about 0.012 in. In the course of 6 to 8 weeks, a heavily loaded two-cycle engine will burn the electrodes as much as 0.040 in. A four-cycle, vertical engine will burn the electrodes about 0.015 in. in the same period, while the old horizontal engine will burn less than half of this amount. It is good practice to adjust the spark plugs at lease once a month to insure steady operation and protect the magneto condenser and windings.

Lubrication

The mechanical maintenance of the compressor is so strongly influenced by the quality of the lubricant, that one can ill afford to be critical of the price.

Lubrication engineers formerly recommended two and sometimes three grades of oil for a gas-engine-driven compressor; one for the bearing circulation, a second for power cylinders, and a third for the compressor cylinders. We have found that one grade, generally SAE 30, is sufficient. When the vapors are especially wet, it is advisable to use a compounded oil for the compressor cylinders. A carbon residue of 0.06 per cent or less and a viscosity index of 80 per cent or better, are the important specifications.

The problem of changing the crankcase oil has been solved for many operators by filling the mechanical lubricators from the crank-case circulation system. All makeup oil is added to the crank case; this will replenish the crank-case contents every few weeks. Some of the new engines are factory equipped with this feature.

The oil consumption will depend upon the type, mechanical condition of the engine and the care exercised by the attendant. Each compressor cylinder will require about 1 qt. per day, and the metallic piston-rod packer about 1 pt. per day. Each 100-hp. four-cycle cylinder, will require 2-qt. a day; a two-cycle cylinder will require 3 to 4 qt. per day. These rates are based on filling the lubricator from the crank case. It will include the crank-case loss and normal wastage. Expressed in terms of horsepower hours per gallon of over-all lubrication the four-cycle unit will run between 2,000 and 3,000; the two-cycle unit will average 1,500 to 2,000 and the old style, four-cycle, double-acting unit will only average 1,000 to 1,500.

Oil Filters

The problem of oil filters is highly controversial, because it is difficult to prove the superiority of one system over another. A few plants have operated years without an oil filter. This is poor practice. There is a wide selection of filters ranging from cheap muslin bags, cotton-waste packs, patented chemical packs, etc., to the elaborate washing and centrifuge equipment. If the value of the oil can be considered on a manufacturing cost rather than a selling price, it is difficult to justify any system more expensive than the cotton-waste pack. This is especially true if the lubricators are filled from the crank case.

With some engines you can combine the oil circulation from the individual engines into a common overhead reservoir. The oil can be filtered in a single unit and dispensed to the various points without the hazard of an individual oil pump failure.

One of the most successful improvements on the vertical gas engines is recent years has been the oil-cooled piston. It has greatly reduced the sticking of piston rings, especially on two-cycle engines. This cooling oil will pick up about 500 B.t.u. per horsepower hour and must be cooled. It is advisable to cool the crank-case oil in any engine where the operating temperature exceeds 150° F. Oil above this temperature tends to oxidize, to become acidic or corrosive, and to form a shellac. While on the other hand, oil at temperatures below 100° F. will loss the desirable fluidity and have a tendency to pick up condensate and emulsify. The desirable operating

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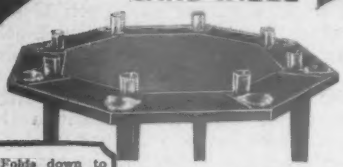

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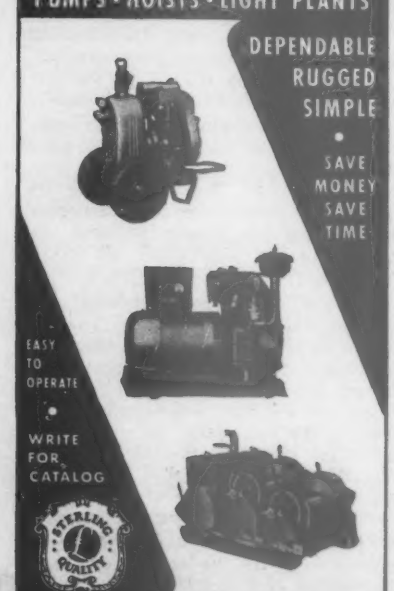

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temperature of crank-case oil is between 120° and 140° F.

Jacket Water

The key to smooth engine performance is to keep the piston and cylinder heads at a temperature below which fuel detonation occurs. This is controlled by the quantity and in certain instances, the outlet temperature of the circulated jacket water.

The jacket water in the old style horizontal gas engine would absorb about 27 per cent of the heat input at full load. A water circulation of 30 gal. per brake horsepower hour would give a 13° F. temperature rise through the power cylinder and another 1° F. through the compressor cylinder. In order to obtain smooth performance and maximum output of a two-cycle horizontal engine it was necessary to limit the temperature rise to 8° F. and outlet temperature to 110° F. The usual engine outlet temperature was about 125° F.

The manufacturers of the new vertical or angle units recommend a jacket-water circulation of 50 gal. per brake horsepower hour. As previously related, the oil-cooled piston absorbs about 500 B.t.u. per brake horsepower hour, a like amount for the compressor cylinder and about 4,000 B.t.u. per brake horsepower hour or one-third of the heat input will be absorbed in the newly designed cylinder jackets and exhaust manifolds. The jacket water will pick up 12° F. at the above circulation. An outlet temperature 160° F. is generally satisfactory. The higher outlet temperatures have resulted in reduced cylinder wear.

The early proceedings of the C.N.G.A. will reveal that there was a time when economy of a closed jacket-water system was questioned. There are several hundred cracked cylinders and heads that will testify that the open jacket-water system is taboo. The soft water used in a closed system should carry an inhibitor to prevent the corrosion of the iron. We have found that a sodium dichromate concentration of 2 lb. per 1,000 gal. to be an excellent inhibitor.

Two other essential features of a jacket-water system that should be included are: Vent the jacket-water system at the high point on the power cylinder or head; and minimize the back pressure on the power cylinder jacket. The jackets should be the last resistance in the jacket-water circuit.

We have found that it requires 4 bbl. of jacket water makeup per horsepower month. Allow 6 bbl. per horsepower month for your cooling tower makeup to cool the jacket-water coils, the same quantity for makeup to cool the gas coils and for "wet exhaust" cooling. The auxiliary equipment to circulate the jacket and tower water generally requires 5 per cent of the total plant power.

Air Cleaners

The air cleaner is a desirable protection against abrasive material that may be carried in the air during dust storms, etc. We carefully micrometered the cylinder wear of power cylinders for 4 years that were alternately protected with air cleaners. We were not able to detect any difference in the wear. This test was conducted at Santa Fe Springs and there were no dust storms of consequence during this period. In another instance, we encountered excessive wear in several air compressor cylinders and rings, operating adjacent to a construction job, where considerable dust and cement were carried with the air. The oil-bath-type air cleaner is very satisfactory. The dry type has not been effective in trapping fine dust particles. The cloth-bag type requires more maintenance and one must accept the hazard of holes developing in the cloth bag. The oil-bath-type air cleaner is also an effective intake silencer, making it possible to install an interior air intake.

The exhaust muffler that induces a secondary air flow around the exhaust line has proven to be an effective silencer and means of cooling the exhaust lines.

Alarms

Automatic signals and shutdown devices have proved their worth in supplementing the operating personnel. The greatest hazard in a compressor plant is the danger of carrying liquid into the compressor cylinders. This will rupture the cylinder and generally result in a fire. We always provide generous-sized intake scrubbers with automatic and emergency manual drains. Should the liquid level rise above one-third of the scrubber capacity a mercoid-float activated alarm is sounded, and a red light will indicate the vessel is in danger. If the level rises above the midposition, an automatic magneto grounding device will shut down the plant. Similar alarms and red lights are often used to call the operator's attention to such important changes as:

(a) Low jacket-water pressure.
(b) Low oil-reservoir level.
(c) Abnormal pressures on compressor manifolds.

Every engine is equipped with an automatic overspeed, shutdown device to insure against a flywheel explosion, etc., in case of a governor failure. This device should be tested at least every 6 months, or you may find to your sorrow that it was not in working condition. Most engines are equipped with a low oil pressure shutdown device. Some of the new engines are provided with high jacket-water temperature shutdown devices. These devices are good insurance.

Dependability is the first requisite

for the prime mover in a compressor plant. A vigilant mechanical maintenance program is the means to this end. We attempt to maintain the equipment in "new engine" condition by means of regular overhaul schedule. This will forestall most involuntary shutdowns and minimize extensive repairs. The frequency of the overhaul is predicated upon the load factor, type of equipment and the experience of the supervising mechanic. A heavier loaded unit may require an overhaul as often as every 8 months. A lightly loaded, slow-speed engine may only require an overhaul every 4 years. The modern angle-type unit should be overhauled every 12 to 18 months. This overhaul would include:

(a) Freeing the piston rings.

(b) Removing the coke from the grooves, piston body, and exhaust ports.

(c) Change or reface (when necessary) the exhaust (or injector) valves, guides and seats.

(d) Check the main and rod bearings.

(e) Clean the jackets and crankcase.

(f) Change the oil filter (every 4 to 6 months).

(g) Check wedge bolts, tie rods and yokes.

(h) Clean the intake (or air) valves, governor or fuel mixer.

(i) Micrometer and record the cylinder wear.

The last item is an important gage on the effectiveness of your maintenance program. The cylinder wear of 0.003 in. per year is normal for a well-operated plant. After a few years of operation you may not detect any change in the cylinder wear. Some mechanics maintain that a "work hardened" or glazed cylinder will not show perceptible wear unless you encounter abnormal operating conditions. A cylinder may wear uniformly as much as 0.070 in. without serious loss of power. A horizontal cylinder will generally wear "out of round" or "egg shaped." Then half of this wear will impair the piston ring action and reduce the power capacity. The average cylinder should operate for about 8 years before reboring. We have run many cylinders more than twice this period. We have one plant equipped with honed cylinder whose wear record indicates that they will outlast any cylinders heretofore used. We generally rebore the cylinder to ⅛ or 1/16 of an inch oversize. We have rebored some cylinders a second time, finishing the cylinder at ¼ in. oversize. The manufacturers have set ¼ in. as the limit.

The crank bearings should have a life of 3 to 4 years. The main bearings should serve for 5 years or better. With a good job of babbitting and a machined fit, the bearing life will be largely determined by the care received from the operator.

TANK FIRES *can* BE PREVENTED

● With the very rare exception of fires originating inside the tank—a tight tank is safe against fire if it is properly equipped with an Oceco Flame Arrestor. A flame arrestor, naturally, can not protect a tank that has been broken open with a direct bomb hit or other cause—but, flame arrestors will keep the resulting fire from spreading to other tanks which have not been broken open.

Oceco Flame Arrestors are approved by Underwriters Laboratories, Inc. They are protecting more than 350,000,000 bbls. of tankage (about 4 times the average total gasoline stocks in this country)—and have a perfect fire record.

No tight tank equipped to Oceco specification — even though located in the middle of a blazing tank farm — has ever been lost by fire.

The cost of an Oceco Flame Arrestor is very small in proportion to the investment being protected. They minimize the dangers of sabotage—reduce fire insurance costs—and are indispensable to companies that carry their own insurance.

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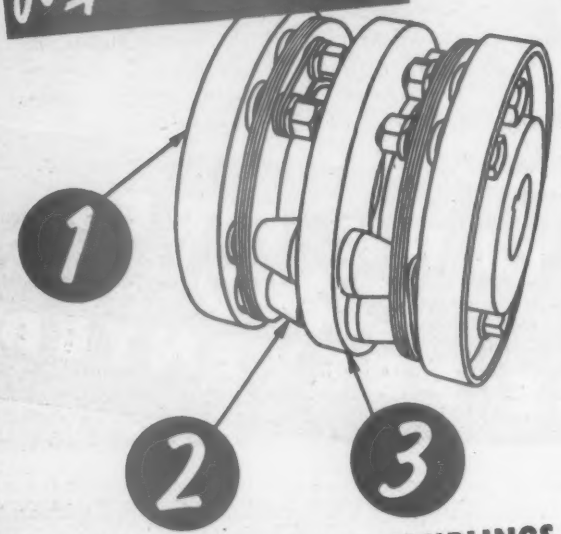
3 REASONS FOR
Dependability



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Long ago Thomas Flexible Couplings enlisted for national defense and are now taking a vital part in winning the war. Write for our catalog (on your letterhead) to see how Thomas can solve your coupling problems.

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A plain cast-iron exhaust valve and seat should average about 6 months' service in a heavy gas engine. A chromium alloy valve and seat with a well-guided and lubricated stem should increase the life considerably.

A mechanical-maintenance program of this order will require one mechanic for every 800 hp. The ratio will run as high as 1,200 hp. per mechanic for the modern units and as low as 600 hp. for old horizontal, double-acting, tandem equipment. This may appear to be a rather high ratio, but it represents a 16-year average for seven plants, ranging in size from 600 to 5,400 hp. It includes the maintenance of all auxiliary equipment, the water and gas coils, etc. This does not mean that for every 800 hp., you might expect to have a mechanic work every fourth day on every 200-hp. engine. Quite to the contrary, our records show that we have only 0.5 per cent "down time" for repairs. This means that, on an average, every engine is down for repairs, overhaul or check, one 8-hour day every 2 months. When an engine is down for overhaul or repair, it is generally advisable to use a crew of about six men in order to minimize the time out of service. Ninety per cent of this down time will be of a voluntary nature. Brief shutdowns of less than 15 minutes' duration are not included in this figure.

The modern gas-engine-driven compressor is the result of keen competition and ingenious design. It is our responsibility to obtain maximum performance from this equipment. We have a job to do!

Oil-Well Pumping Practices

(Continued from page 51)

to lubrication and of periodic inspections and cleanings. Services of skilled personnel are required.

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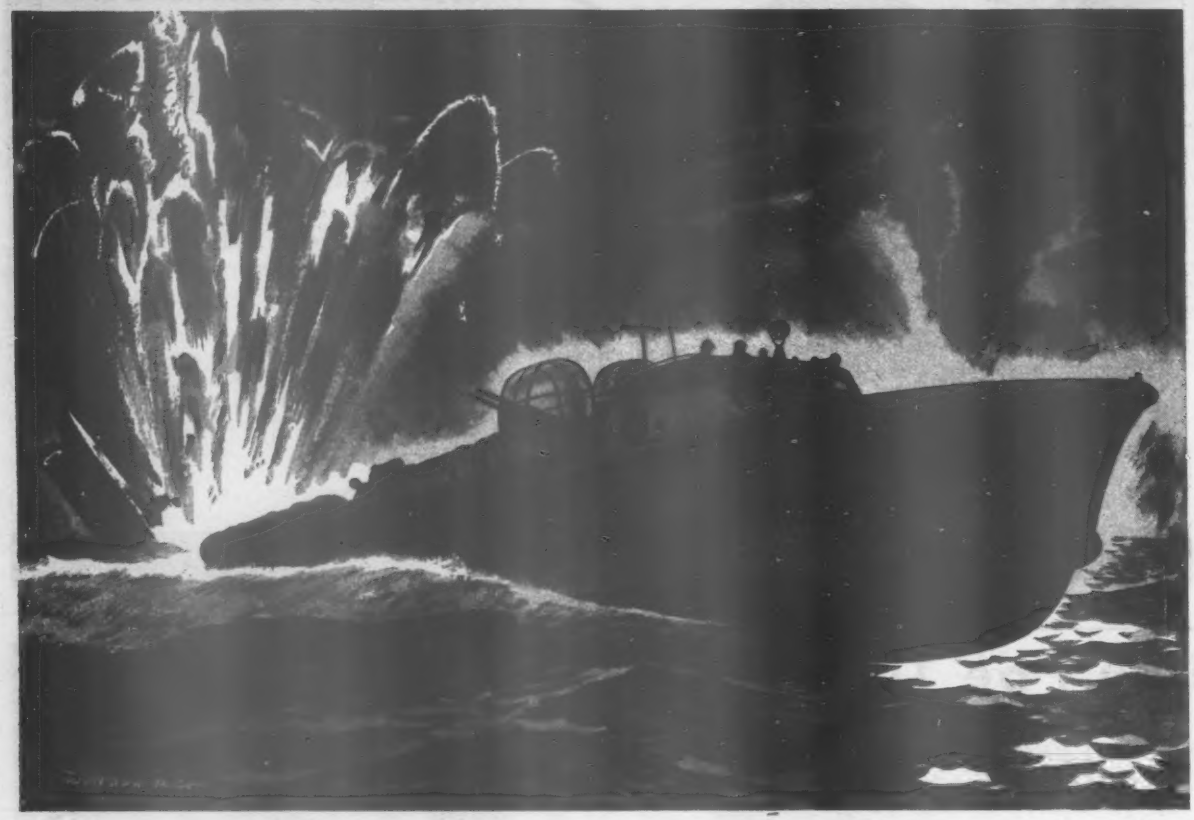

What makes a mosquito buzz?

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Such hit and run fighting demands motors that don't miss. They must hum flawlessly to take a 77-foot cockleshell under enemy guns. And PT motors *don't* miss—RPM DELO helps guarantee that.

Developed to solve the special problems of Diesel lubrication, RPM DELO ends the danger of stuck rings. It actually cleans motors gummed by other oils. RPM DELO's special additives guard bearings against corrosion, minimize sludge, cut wear to a fraction.

RPM DELO is one of the Petroleum Industry's major contributions to this war... a contribution as important as the fighting Diesels it helps keep going. On the high seas, in war plants, on farms and in the railroad service, "DELO" is the lubricant that enables the wheels of victory to revolve smoothly and unceasingly towards peace.

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CALCULATION OF FUEL COSTS

IN preparation of any cost estimate concerning oil-field operations, it is usually necessary to know something about the fuel requirements and costs. If the fuel purchased is natural gas, one meter may be used to measure gas for the whole lease, and if individual well studies are being made, it is necessary to estimate the fuel consumption by the prime mover at that particular well.

In other instances where gas lines may be leaking appreciable amounts of gas, estimated fuel consumption for individual units is used as a check on metered figures.

Fuel Consumption

Fuel consumption curves for various types of engines are shown in Fig. 1, as B.t.u.-input per brake horsepower hour vs. per cent of engine full-load rating. Fuel requirements per brake horsepower hour for a particular type of engine depends to some extent on engine design and operating characteristics. The curves shown in Fig. 1 were made for typical engines of medium horsepower rating (25 hp. to 250 hp.).

Fuel-consumption figures furnished by the engine manufacturer are usually based on the full-load rating of the engine. Engines operating below their rated horsepower consume more fuel per brake horsepower hour delivered at the shaft. Fuel consumption for engines operating at "no load" may be from 25 per cent to 45 per cent of that necessary at full load. In the preparation of cost estimates, the actual brake-horsepower requirements for the equipment may not be available. Consequently fuel costs are usually computed on the assumption that the engine is operating at full load.

Steam Equipment

Estimating the fuel requirements and costs for steam equipment on drilling rigs presents a slightly more difficult problem. It is usually necessary to know the horsepower requirements of the rig. For rotary rigs the horsepower requirements for the mud pump may be obtained from the manufacturer's data. Horsepower requirements for rotary tables are usually based on one horsepower for each revolution per minute of the rotary table.

The average rotary rig for a 5,000-ft. well requires approximately 300 hp. Cable-tool rigs may require from 50 to 85 hp. One boiler horsepower is equivalent to 33,479 B.t.u. per hour. As a general rule the over-all thermal efficiency of the portable-type boiler used in the oil field is approximately 50 per cent although somewhat greater efficiencies may be obtained by the use of steam-saving equipment. Consequently the fuel requirements for a boiler are approximately 67,000 B.t.u.-hour per horsepower. The heats of combustion for fuels ordinarily used in the oil field are shown in Table 1.

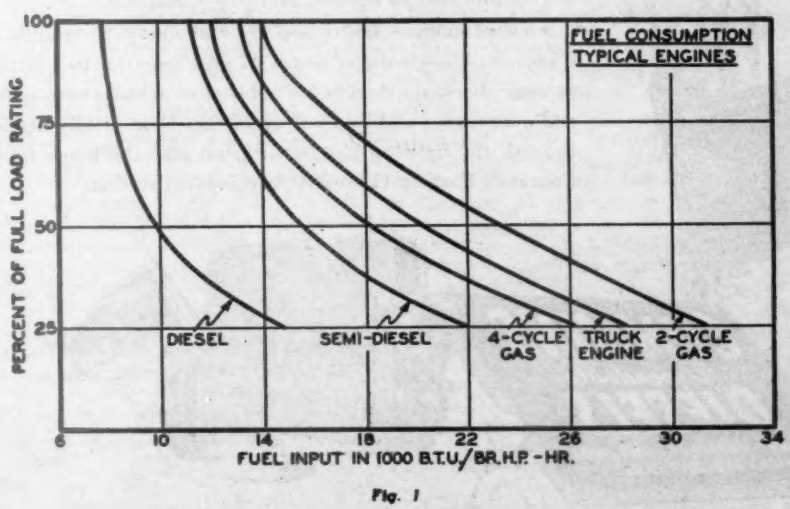

Fig. 1

Examples of Calculations

Calculations involving fuel costs are illustrated in the following examples:

1. **Steam equipment.**—Calculate the fuel cost for a rotary rig, equipped with steam boilers and using natural gas as fuel. Horsepower requirements are 300 hp.; cost of gas is 16 cents per 1,000 cu. ft.

Heat of combustion = 1,000 B.t.u per cu. ft. (Table 1).

Fuel requirement = 300 × 67,000 × 24 ÷ 1,000 = 483,000 cu. ft. per day.

Fuel cost = 483 × 0.16 = $7.74 per day.

2. **Semidiesel engine.**—Calculate fuel cost for a 40-hp. semidiesel engine using crude oil as fuel. Cost of crude oil is $1.20 per barrel.

Heat of combustion 141,000 B.t.u. per gal. (Table 1).

Fuel input per b.hp. = 12,500 B.t.u. per b.hp. (Fig. 1).

Fuel requirement = 12,500 × 40 × 24 ÷ 141,000 = 85 gal. per day.

Fuel cost = 85 × $1.20 ÷ 42 = $2.43 per day.

3. **Gas-engine (2-cycle)**—Calculate fuel cost for 30-hp., 2-cycle engine. Cost of gas is 18 cents per 1,000 cu. ft.

Heat of combustion = 1,000 B.t.u. per cu. ft. (Table 1).

B.t.u. input per b.hp.-hour = 14,000 B.t.u. per b.hp.-hour (Fig. 1).

Fuel requirement = 14,000 × 30 × 24 ÷ 1,000 = 10,080 cu. ft. per day.

Fuel cost = 10.08 × $0.18 = $1.81 per day.

TABLE 1—AVERAGE HEATING VALUES

Fuel	B.t.u. per cu. ft.	B.t.u. per lb.	B.t.u. per gal.
Natural gas,	1,000	21,800	.....
Propane	2,500	21,500	88,800
Butane (commercial)	3,000	21,000	102,000
Gasoline (60° A.P.I.)	....	20,700	127,000
Fuel oil (27° A.P.I.)	....	19,400	144,000
Kerosene (41° A.P.I.)	....	19,800	135,000
Crude oil (30° A.P.I.)	....	19,500	141,000

This *Fuel Conservation* started 15 years ago!

The principle of Fuel Conservation is to eliminate waste without sacrificing any vital need. For example:

In 1928, fire protection for its harbor was a vital need at Portland, Maine, but natural New England thrift rebelled against paying for fuel which would be consumed in idleness . . . in merely keeping up steam to assure having fire protection when it was demanded. After a thorough investigation, the fire boat, City of Portland, was ordered and Cummins Diesel power was chosen for three reasons: *First*, the Cummins Diesel's proved easy starting made certain that the boat would be ready to go any time, day or night. *Second*, the engine's compact size and light weight per horsepower made it an ideal plant for fire pumps and main propulsion. *Third*, the Cummins Diesel's recognized fuel economy and low maintenance assured a low operating cost.

In 15 years of duty on Portland's water front, and in comparable terms of service in fire boats at Chicago and Ketchikan, Alaska, Cummins Diesels have consistently demonstrated their ability to provide maximum protection at a minimum cost in dollars, manpower and fuel.

Such economy—multiplied by the many thousands of Cummins Diesels doing scores of jobs essential to a nation at war—becomes doubly valuable now when every dollar and every man and every drop of fuel is so vitally needed to push the fight on the battle front and the home front. CUMMINS ENGINE COMPANY, Columbus, Indiana.

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Engineering Fundamentals

No. 113

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

DIRECTIONAL WELL SURVEYING

METHODS of measuring the directional deviation of a well from vertical may be placed in three general classes. These are: (1) Magnetic instruments, (2) gyroscopic instruments, (3) orientation methods.

Magnetic Instruments

The magnetic compass is widely used for making directional well surveys in open and uncased hole. The popularity of this method is chiefly due to its simplicity and general reliability. In surveying a cased well or a portion of a hole in which disturbances from magnetic deposits are present the readings of the magnetic compass cannot be depended upon and one of the other two methods is used.

Magnetic survey instruments are available either as (1) single-shot instruments which take only one reading on a single photographic disk film during one run into a well, or (2) as multiple-shot instruments, which record a large number of readings on a motion-picture film during one run into and out of a well.

Single-shot instruments are provided with a "daylight loading magazine" for inserting the disk films into the instrument without exposing them prematurely. A "daylight developer" is also provided, by means of which a disk may be removed and properly developed when the instrument is withdrawn from the well.

The compass unit in both single-shot and multiple-shot instruments is substantially the same. Various methods are used for providing free suspension of the compass in instruments. One method employs a compass floating on a liquid of low surface tension, held concentric in the compass chamber by a fine wire through the center of the compass. In another make of instrument the compass card is provided with a centered jewel which rests upon a nonmagnetic metal needle exactly centered in the instrument case. In this instrument also the compass is in a fluid-filled chamber, the fluid absorbing any shock and reducing the resistance to rotation of the compass. The compass of another instrument of this general type is mounted on a jewel cup which rides on a steel-tipped pivot, in a fluid-free compartment.

All self-contained single-shot and multiple-shot directional instruments are clock-controlled, and employ a dry-cell battery circuit, light bulbs, and camera unit for exposing the film at the proper time. The photograph obtained shows the position of plumb-bob cross-hairs with respect to the center of a concentrically lined disk and also shows the position of the cross-hairs with respect to the position of the compass needle which is photographed on the same chart.

A representative disk chart obtained with a single-shot instrument is illustrated in Fig. 1.* After development of the film, one can count the number of rings outward from the center of the chart to the center of the cross-hairs and obtain the angle of deviation. To determine the direction of the deviation a straight line is drawn from the center of the disk through the center of the cross-hairs to the bearing graduations on the outer edge of the disk. Note in the chart illustrated in Fig. 1 that the deviation from vertical is 12°† and that the direction of such deviation is N. 57° E.

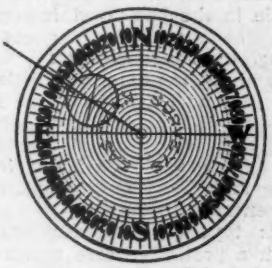


Fig. 1

Instruments of this type are run in a protective casing which is made of nonmagnetic material to prevent disturbance of the compass. This case may be lowered into the hole on a sand line, or on tubing or drill pipe.

Single-shot instruments are available in two sizes. The large instrument is used in open hole, while the small size may be lowered through drill pipe equipped with conventional wire-line core-barrel bits and a record taken with the instrument extending through the bit into open hole. The small single-shot instrument may be used as a deviation instrument inside of drill pipe when the direction of the deviation is not desired.

One type of multiple-shot magnetic directional survey instrument differs from the others in that the instrument is completely controlled from the surface. This instrument is run into the well on an insulated electric cable through which electrical impulses for operating the instrument are transmitted from a control panel in a truck at the surface. The instrument is illustrated in Fig. 2.* The deviation from vertical is registered by a steel ball which rolls on a graduated spherical glass. The glass is graduated with concentric circular lines from which the deviation angle can be read, and with radial lines to aid

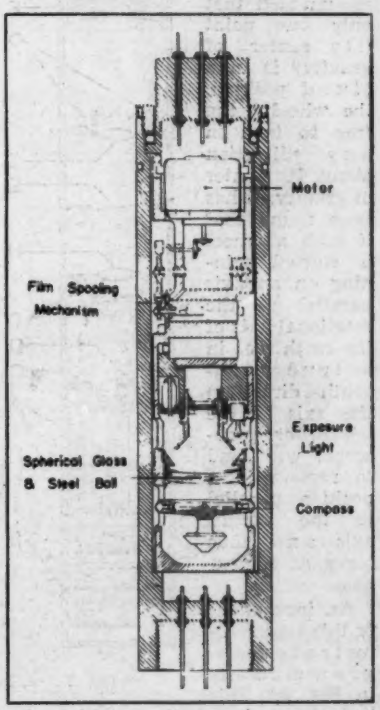


Fig. 2

*Courtesy Eastman Oil Well Survey Co.

†Assuming that each ring is equivalent to 1°, which for this particular chart would be true if it were taken with an instrument having a maximum range of 18°.

*Courtesy Schlumberger Well Surveying Corp.

Series prepared by Glenn M. Stearns, associate professor of petroleum engineering, University of Oklahoma

in reading the angle between the ball and the compass needle, this angle being the direction of drift with respect to magnetic north. The compass is mounted below the spherical glass. When the exposure light is illuminated a picture is obtained on a motion-picture film of the compass needle, the steel ball, and the graduation lines on the glass supporting the ball. Because of control from the surface, time is saved in obtaining the records. The standard number of shots that can be obtained during one trip into the hole is 50.

Gyroscopic Methods

Since the gyroscope is not influenced by magnetic disturbances, an instrument employing this principle can be used for determining the direction of deviation in cased as well as uncased holes and adjacent to magnetic ore bodies. A gyroscope consists of a spinning wheel, so mounted that only one point (its center of gravity) is in a fixed position, the wheel being free to turn in any direction about its center of gravity. It has been found that if such a wheel is started spinning on an axis parallel to the rotational axis of the earth (i.e., in a true north-south direction) the axis of the wheel, or gyroscope, will tend to remain in a position parallel to the earth's axis and thus serve as a compass.

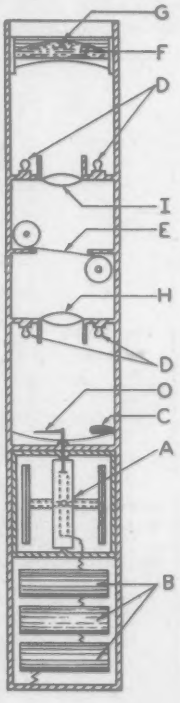


Fig. 3

An instrument of this type is illustrated diagrammatically in Fig. 3.* This instrument is of the multiple-shot type. The instrument consists of a gyroscope and motor unit (A) which is driven at a speed of about 14,000 r.p.m. by electric power from the dry-cell batteries (B). The clock (C) is synchronized with a surface clock so that each record can be correlated with the depth at which it was taken. The instrument clock (C) controls the electric circuit to the light bulbs (D) and thus determines the time at which the exposure of the film (E) occurs. The film is turned, at the proper time as controlled by the clock, by an electric motor receiving power from the dry-cell batteries.

A box-level unit (F) has its bottom and top made of special ground glass. The top is spherical and is provided with concentrically ringed graduations. The space inside the unit is filled with a liquid of low surface tension with a small air bubble (G) on the surface of the liquid against the concentrically ringed glass top. The position of this bubble with respect to the concentric graduations indicates the deviation from vertical.

At the time of exposure of the film in a well, the position of the gyro pointer (O) and reading of the watch (C) are recorded through the lens (H) upon the film, and the position of the bubble in the box level is recorded upon the same film by exposure through the upper lens (1).

For high-temperature wells the box level gage as described above is replaced by a plumb-bob cross-hair unit as already described in connection with photographic deviation instruments and single-shot magnetic instruments.

This type of instrument may be run in a protective case attached to wire line, drill pipe, or tubing in a cased hole. In an uncased hole the instrument should be run on a wire line inside of tubing or drill pipe, or attached to tubing or drill pipe in order to reduce the possibility of losing the instrument in the hole.

The film used has a capacity of 1,000 to 1,200 pictures. Readings may be taken at regular depth intervals on both "in" and "out" runs, and thus a check is obtained as to the accuracy of the survey. A depth interval of 100 ft. is convenient for taken readings on a wire line. A reading for each stand is convenient when running the instrument on drill pipe.

Drill-Stem Orientation

Drill-stem orientation, like the gyroscope, is not affected by magnetic disturbances and thus may be employed in determining the direction of deviation in a cased, or partially cased, well.

This method may employ any type of instrument which will record the angular inclination of the hole from vertical. The orientation process consists of lowering the instrument into the well on drill pipe in such a way that the position of the instrument with reference to any chosen direction is always known. This is accomplished in the following manner:

The well-surveying instrument is aligned with some arbitrarily chosen bearing by clamping a special transit to the instrument and sighting the transit at a chosen reference point. (A telephone pole, the tip of a church steeple, or any distant object may be used as a point of reference.) At the same time another transit up in the derrick is clamped to the top of the same stand of drill pipe to which the survey instrument is attached and the clamp adjusted by means of a micrometer screw so that the vertical cross-hair coincides with the distant object used as a reference point. The lower clamp is then removed from the instrument, the derrick transit is removed from its clamp (care being used not to disturb the position of the clamp), and the pipe is lowered into the hole. Care is used to prevent disturbance of the clamp at the top of the lowered stand when setting slips, stabbing, and tonging the next stand of drill pipe. Following the tonging of the next stand, the floor transit is secured to the clamp that came down, and the transit turned to the distant reference point in such a way as to measure the angle that the drill pipe and instrument have turned since the clamp was originally set by the derrick man. In the meantime, the derrick operator places another clamp, sent up to him on the elevator bails, upon the top of the tonged-up stand and aligns it with the distant target. In this manner, a record is kept of the angle through which the instrument turns as it is lowered into the hole, and position of the instrument with reference to any direction can be computed at any time. Such direction can then be projected onto the record from the instrument and the true direction of any deviation determined.

There has been some controversy as to the accuracy of directional surveys made by orientation methods, because it was felt by some that the torque in a long string of drill pipe could be sufficient that the resultant "twist" in the pipe would make the final results inaccurate. However, experience has shown that if the pipe is lowered and allowed to turn freely, the full weight of the string applied before setting each clamp, and the string worked up and down off bottom, the orientation method gives results within practical limits of accuracy.

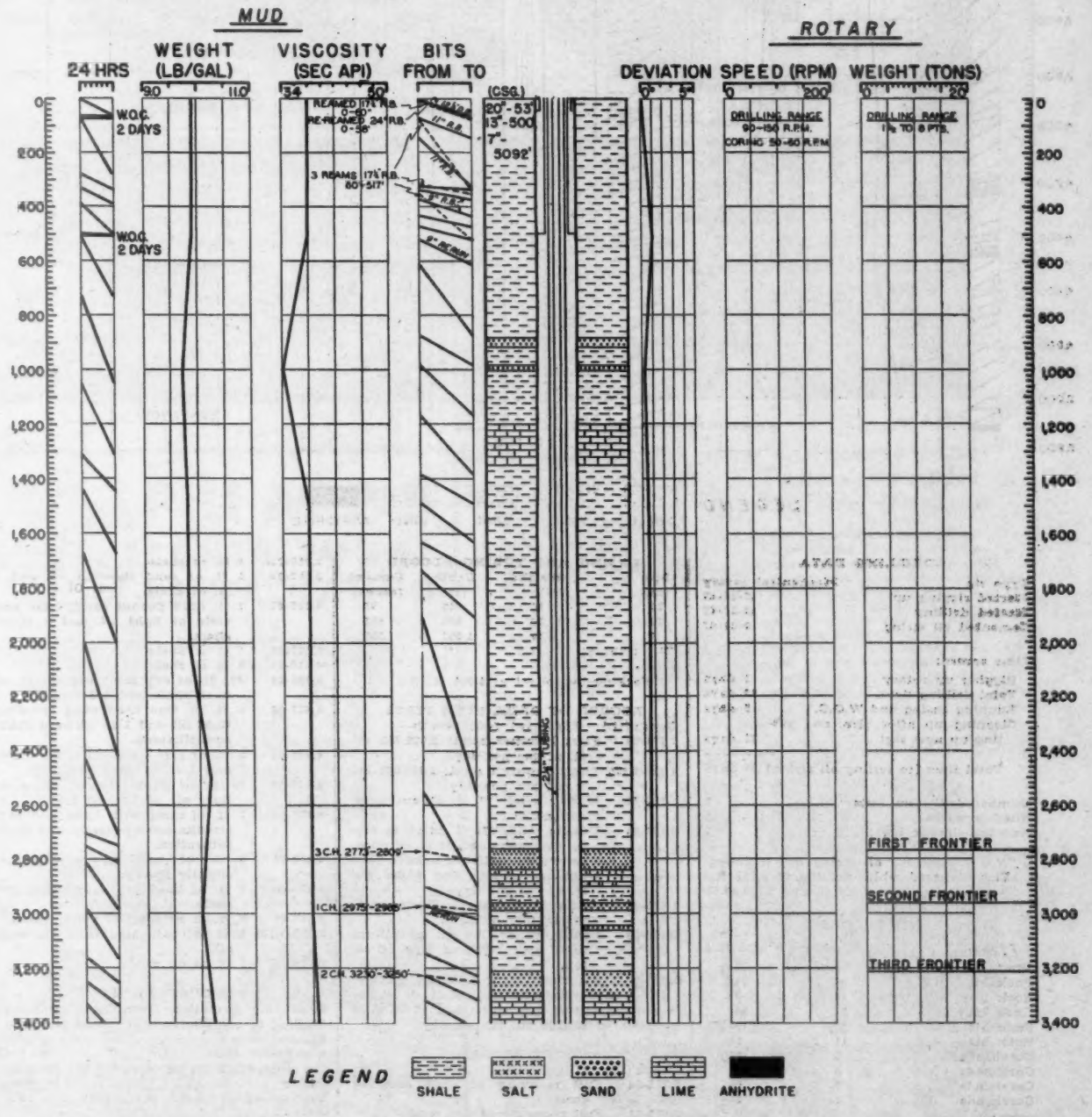
Credit due Eastman Oil Well Survey Co., Schlumberger Well Surveying Corp., Lane-Wells Co., and Sperry-Sun Well Surveying Co. for furnishing information used in the preparation of this discussion.

*After John R. Suman in Chapter 10 of "Elements of the Petroleum Industry," A.I.M.E., 1940.

Discovery Well, Steamboat Butte Field, Fremont County, Wyoming

BRITISH-AMERICAN OIL PRODUCING CO., 1 TRIBAL "E"
C NE NW NW 5-3n-1w
Elevation (rotary bushing) 5,709 ft.

CONTRACTOR
Parker Drilling Co., Tulsa



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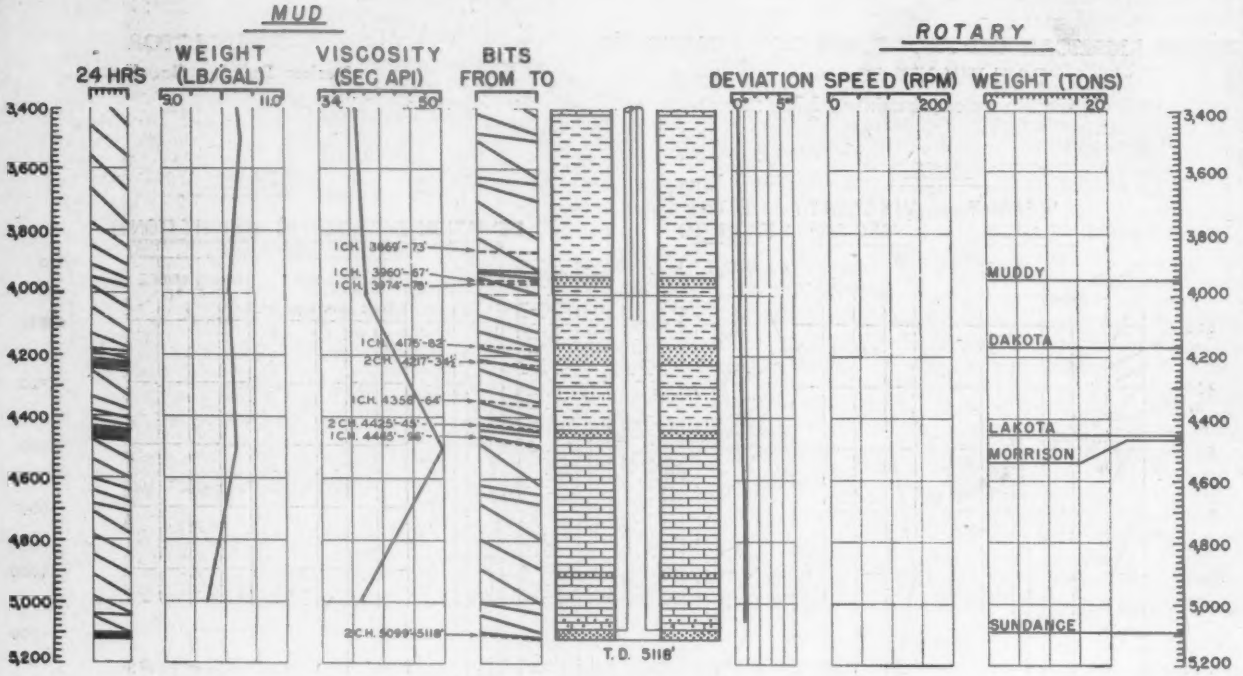
Journalog

Discovery Well, Steamboat Butte Field, Fremont County, Wyoming (Continued)



DRILLING DATA

Type rig	Mechanical rotary
Started rigging up	12-16-42
Started drilling	12-21-42
Cemented oil string	3-19-43

Time record:

Rigging up rotary	5 days
Total drilling days	62 days
Running casing and W.O.C.*	5 days
Cleaning up after fire, and setting up new rig†	22 days
Total time (to setting oil string)	94 days

Number drill-stem tests	7
Number cores	19
Number electric logs‡	2

*W.O.C. time for oil string not included.
†Fire occurred while drilling at 4,182 ft.
‡Surveys run from 4,224 ft. and 5,118 ft.

BIT RECORD

Type—	Number	Size (in.)
Drag	1	12¼
Rock bit	3	11
Rock bit	46	9
Rock bit	*1	24
Rock bit	*3	17¼
Rock bit	†1	6⅛
Coreheads	6	7½
Coreheads	5	7
Coreheads	3	6¾
Coreheads	1	6½

*Reaming.
†Drilling out cement in oil string.

CASING AND TUBING RECORD

Size (in.)	Weight (lb.)	Depth (ft.)	Cement (sacks)
20	90	53	75
13	50	500	485
7	28	5,092	500
2½ (tubing)	6.5	(*)	...

*Working barrel set at 4,086 ft.

RECORD OF DRILL-STEM TESTS

Depth (ft.)	Formated test; results—
2,774-94	First Frontier sand; 2,000,000 cu. ft. of gas per day.
3,228-3,335	Third Frontier sand; 1,250,000 cu. ft. of gas per day.
3,960-74	Muddy sand; 75 ft. oil-cut mud; no gas.
4,167-82	Dakota sand; 370 ft. of oil in 4½-in. drill pipe and 30 ft. of muddy water (believed to have been drilling water) and 69,000 cu. ft. of gas per day.
4,411-45	Soft sand stringer in Fuson shale; 155 ft. oily mud.
4,447-85	Lakota sand; 150 ft. of oil-cut mud with 3 gal. of free oil on top.
5,093-5,118	Sundance sand; 2,650 ft. of 28.4° gravity oil and 950 ft. of oil-cut mud; gas estimated at rate of 200,000 cu. ft. per day.

CORE RECORD

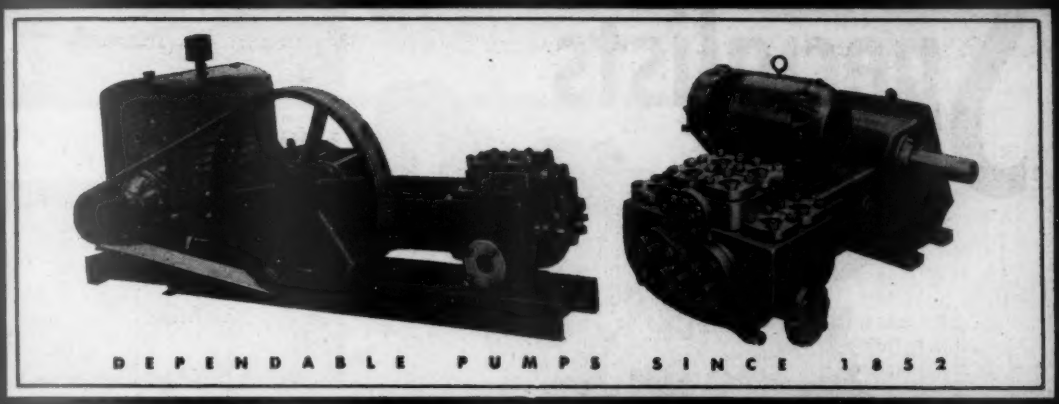
Depth (ft.)	Recovery—
2,783-94	Full recovery of sand showing gas.
2,975-85	Full recovery of dry sand.
3,230-40	3 ft. of sand, slight odor of gas.
3,240-50	6 ft. of sand, slight odor of gas.
3,869-73	4 ft. of shale.
3,967-74	5 ft. of sand showing oil and 1 ft. of shale.
4,175-82	1 ft. hard porous sand, odor and stain of light oil, and 5 ft. of shale.
4,207-16	5 ft. of shale.
4,216-24	8 ft. of shale.
4,356-64	3½ ft. of dry sand and 4½ ft. of hard shale and siltstone.
4,425-35	6 ft. of fine hard sand showing light oil and 2 ft. of hard shale and siltstone.
4,435-45	6 ft. of fine hard sand, no show, and 2 ft. of hard shale.
4,445-55	10 ft. of broken sand, show of light oil at 4,447-50 ft.
4,455-65	7 ft. of sand with hard and soft streaks, some porosity, and some saturation.
4,465-75	8 ft. of hard green siltstone, slightly shaley.
4,475-85	9 ft. of hard green siltstone and shale.
4,589-96	7 ft. of soft, white water sand.
5,099-5,109	9 ft. of saturated sand showing oil.
5,109-18	4 ft. of oil sand.

PRODUCTION TESTS

Producing formation	Sundance sandstone
Method of completion	Beam pumping*
Started tests	4-27-43
Completed tests	5- 6-43
Oil production (24-hr. periods)	600-823 bbl.†
Water	None
Gravity of oil (A.P.I. corrected)	28.5°

*Pumping rate, 18 64-in. s.p.m.
†Average cut, 2/10 of 1 per cent asphalt.

McGOWAN PUMPS *for the Petroleum Industry*



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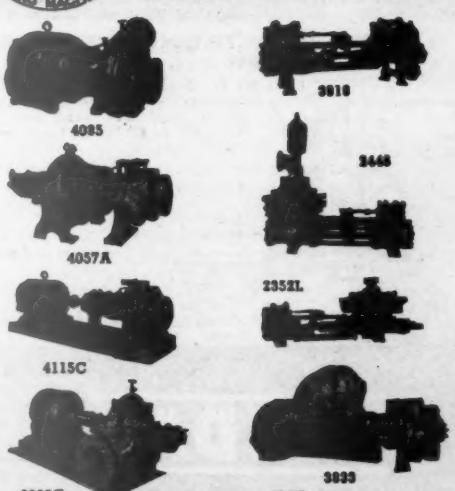

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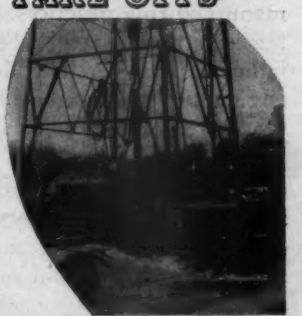

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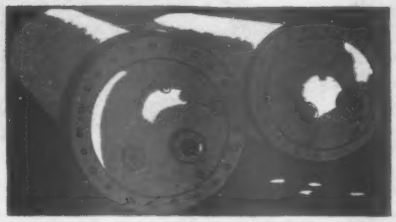
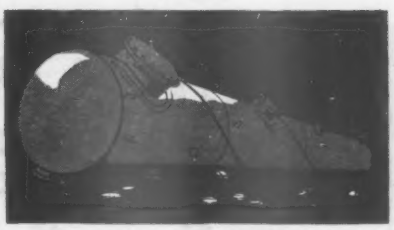


2. AUTOCLAVES

3. ISO BUTANE REFLEX DRUM

4. STYRENE STORAGE TANK

5. BUBBLE TOWER



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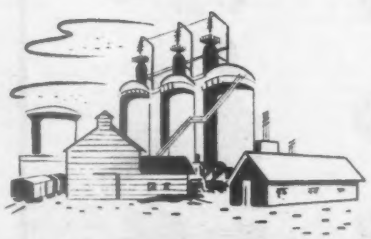

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REFINING

Normal Butane Is Not Being Withdrawn, Says Davies

WASHINGTON, D. C.—Normal butane is not being withdrawn from refinery operations or other uses under Directive 75 of the Petroleum Administration for War, according to Ralph K. Davies, deputy administrator. The directive is intended only to increase the quantities of butylenes and isobutane for the manufacture of petroleum war products.

"Apparently there has been some misunderstanding among refiners and producers of natural gasoline as to the intent of Petroleum Directive 75," says Mr. Davies. "Some individuals have interpreted the directive as meaning that all normal butane must now be diverted from normal channels for use in the manufacture of petroleum war products only. This is not true.

"Directive 75 requires that butylenes and isobutane—but not normal butane—be used only in the manufacture of aviation gasoline, synthetic rubber, or their components.

"The directive does not affect the use of normal butane, provided that isobutane and butylenes admixed with it are first removed to the extent required by the directive for diversion to aviation gasoline or synthetic rubber manufacture."

Fuel Oil May Be Sprayed on Coal to Reduce Losses

WASHINGTON, D. C.—Coal operators are now permitted to spray residual fuel oil on coal as a means of reducing windage loss and preventing freezing, Harold L. Ickes, petroleum administrator, announced. PAO 13, which had banned, except in certain instances, the use of either distillate or residual fuel oil for coal-spraying purposes was amended.

Corpus Christi Refiners to Add About 750 New Workers

CORPUS CHRISTI, Tex. — About 750 new employes, more than two-thirds of whom will be permanent, are to be brought to Corpus Christi within the next few months by two of the city's aviation-gasoline refineries, according to officials of Sinclair Refining Co. and Great Southern Corp.

About 200 of the temporary workers and 250 of the permanent will come from out of town. Some of the 200 construction workers being added by the Sinclair plant already have arrived. The temporary group will be employed here for about 3 months.

Sinclair expects to add about 400 employes the first of the year and at least 60 per cent of them will be hired locally. The 160 or so from other places are expected to bring their families.

Sinclair now employs 1,100 at its Corpus Christi plant. Great Southern plans to add about 150 workers late in December or early in January.

Senate Passes Measure for Gasoline-From-Coal Plants

WASHINGTON, D. C.—The Senate last week passed and sent to the House a bill authorizing expenditure of $30,000,000 for construction of demonstration plants to produce gasoline from coal.

Senator O'Mahoney, Wyoming, who sponsored the measure, declared the Government must pioneer in this field if the United States is to maintain aviation leadership after the war.

Arguing that American petroleum reserves are steadily falling off, Senator O'Mahoney said that unless some way is found to produce synthetic liquid fuel "our supply will not last more than 20 years."

Senator Danaher, Connecticut, contended the measure "collides head-on with everything this country has stood for" in the relations of government with commercial enterprise.

British-American Plant Dedicated to War Service

TORONTO, Ont.—The new aviation gasoline and lubricating-oil refinery of British-American Oil Co. at Clarkson, near Toronto, erected at a cost exceeding $8,000,000, without government subsidy, was formally opened by G. R. Cottrelle, oil controller, on November 15.

Primarily intended as a lubricating-oil plant with motor gasoline as a

Sketches of Plant Operators

C. O. GARBRECHT, general superintendent for Bay Petroleum Corp., Denver, Colo., entered petroleum refining 23 years ago by way of the sulfur business. After receiving a chemical engineering degree from Rice Institute, Houston, Tex., in 1920, he joined the Texas Co. as chemist on a sulfur exploration project, later becoming resident chemist for the Freeport Sulphur Co. when sulfur-mining operations started. In this connection he had opportunities to study the refining operation of the Freeport Asphalt Co. refinery nearby.

After 3 years he obtained leave from the Freeport Sulphur Co. and continued his graduate work at Harvard University, finishing in 1925, with majors in organic chemistry.

After leaving Harvard, he was made chief chemist for Crystal Oil Refining Co. and later refinery engineer for Atlas Oil Corp., Shreveport, La.

In 1928 he became superintendent for Imperial Refining Co. at El Dorado, Ark., and later at their Ardmore, Okla., refinery. He joined Tide Water Oil Co. in 1930 as light-oil superintendent at the Drumright, Okla., refinery, leaving in 1934 to become chief operating engineer for the Ashland Oil & Refining Co., Ashland, Ky. In 1936 he was made general superintendent for Talco Asphalt & Refining Co., Mount Pleasant, Tex., and assisted in the construction of that plant.

He joined Bay in 1939 as superintendent of the Denver refinery and was made general superintendent in charge of refining operations in 1942, the position he now holds.

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byproduct, the plans were drastically changed to meet the rising demand for aviation gasoline for the Commonwealth Air Training Plan. The plant is unique in that no motor gasoline whatever will be manufactured, though later it is expected the plant will be revamped to meet peacetime needs.

DPC Increases Its Contract With Standard of Louisiana

WASHINGTON, D. C.—Jesse Jones, secretary of commerce, announced that Defense Plant Corp. has authorized an increase in its contract with Standard Oil Co. of Louisiana, to provide additional facilities at a plant in Louisiana at a cost of approximately $125,000, resulting in an overall commitment of approximately $1,740,000. Standard of Louisiana will operate these facilities, title remaining in DPC.

Alien Chemical Patents Abstracted by A.C.S. Group

CHICAGO, Ill.—The chemical patents and patent applications vested by the Alien Property Custodian have been abstracted by the Chicago section, American Chemical Society and are now being indexed by a committee of the Science and Technology Group, Special Libraries Association. Beginning in January 1944, these abstracts will be published in 31 classified, indexed pamphlets, to be followed by a master index and a supplement of new abstracts. The prices, if demand is adequate to justify them, will be $1 for any booklet and $25 for all 33 booklets. Orders should be placed not later than December 10. Order blanks may be had from the Alien Property Custodian, Field Building, Chicago 3, Ill.

Top Priorities Assigned More 100-Octane Plants

CHICAGO—All 100-octane plants remaining on the Petroleum Administration for War construction program have been granted top priority ratings and several special directives have been issued to speed up the manufacture and delivery of necessary materials.

This announcement was made here last week by Charles E. Wilson, who at the time he spoke before the annual meeting of the American Petroleum Institute, was vice chairman of the War Production Board. The day after Mr. Wilson addressed the A.P.I. meeting, his resignation from WPB was accepted to permit return to his civilian position as president of the General Electric Corp.

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Amt. in form of Glucosate	Amt. as SODIUM BICHROMATE dichromate	Application	Saving
17 pounds	100 pounds	Calcium Brine	83 lbs.
17 pounds	200 pounds	Salt Brine	183 lbs.
34 pounds	500 pounds	Cooling Water	466 lbs.
	CHROMIC ACID		
3 pounds	66 pounds	Calcium Brine	63 lbs.
3 pounds	132 pounds	Salt Brine	129 lbs.
10 pounds	330 pounds	Cooling Water	320 lbs.

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Help us to stop the waste of chromium ore. Switch to Chrom Glucosate at once and tell your business acquaintances the story of Chrom Glucosate too.

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WEP Increases Throughput of 24-In. Extension

As the result of adjustments made at stations on the eastern extension of the War Emergency Pipelines, Inc., 24-in. crude oil line, throughput will be increased at the end of this week.

In the November 1-14 period 297,394 bbl. daily were shipped from Longview, Tex. At the same time 294,562 bbl. daily were shipped from the Norris City, Ill., terminal of which approximately 40,000 bbl. were shipped direct by tank cars, 30,000 bbl. were forwarded to Ohio Oil Co. lines at Enfield, Ill., and the remainder was moved eastward through the 24-in. extension.

Tests are underway on the section of the WEP 20-in. products line between Beaumont, Tex., and Norris City, Ill. Less than 50 miles of 20-in. remain to be laid to complete it to the East Coast.

In the comprehensive review, entitled, "Building the Big Inch Pipe Lines" delivered by Burt E. Hull, vice president and general manager of WEP, at the A.P.I. meeting in Chicago, Ill., November 10, he mentioned that in the building of the two lines, the company had audited and approved four copies each of approximately 6,000 contractor weekly pay rolls, covering 16,000 men. During the peak of activity, June to August 1943, these pay rolls averaged $1,000,000 per week, and disbursements for purchases of steel pipe, freight, and other materials averaged $2,000,000 per week.

Operating at full capacity the big-inch line moves crude oil at about 4.5 miles per hour, or 108 miles per day. The travel time from Longview to the eastern seaboard requires about 12.5 days.

War Needs Demand Tennessee Gas Line

Designation of the Corpus Christi-West Virginia natural-gas pipe line as a must war project by federal authorities may halt any local efforts to stop its construction, Gov. Coke Stevenson of Texas has stated.

Governor Stevenson said that he had not changed his opinion that the line should be stopped unless it can be proved that only gas now wasted will be carried through it.

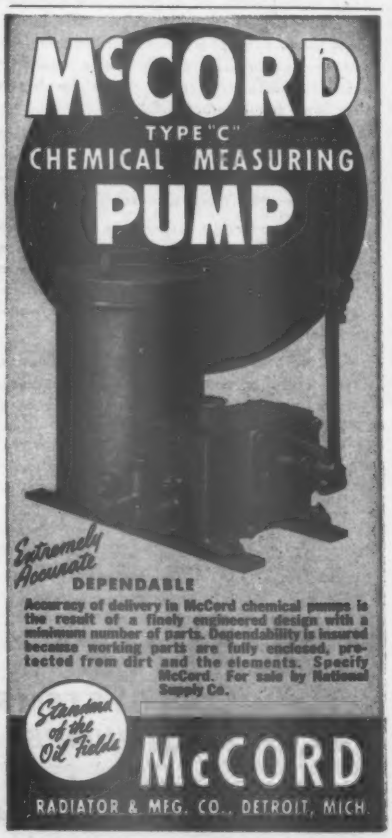
"But I do not know right now how superior is that order from the War Production Board," he added.

The governor received permission from Chicago Corp., which acquired the construction permit through purchase of Tennessee Gas & Transmission Corp., to make public records of its negotiations.

The Federal Power Commission order declared that WPB found: (1) The pipe line must be built; (2) it must be completed by the fall of 1944, and (3) it is necessary to insure an adequate supply of natural gas in the Appalachian area.

Governor Stevenson commented that it was interesting to see how detailed were the FPC and WPB orders to a private enterprise.

The line is to be supplied, the record shows, from Stratton and Agua Dulce fields in the Corpus Christi area. Of 3 trillion cubic feet of estimated reserves in these fields the Chicago Corp. owns 2 trillion and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the remaining third can be bought on terms of 5 cents per thousand cubic feet similar to a contract already made between Chicago Corp. and the Tennessee corporation, according to the record.

Texas-Empire-Tidal Installs Tanks at Sour Lake, Tex.

Surveys have been completed and preparations made for the construction of two 80,000-bbl. tanks at Sour Lake, Tex., for the Texas-Empire-Tidal Pipe Line for handling shipments of crude destined for the Cities Service Oil Co. refinery at Lake Charles, La. Contract for excavation will be let this week.

Company Being Organized to Build Elk Basin Outlet

Yale Pipe Line Co. is reported to be in the process of organization by a group of Denver, Colo., oil men for the purpose of building the proposed line from the Elk Basin and Frannie fields on the Wyoming-Montana boundary to refineries at Billings and Laurel, Mont. J. G. Dyer, Denver, formerly head of Continental Oil Co.'s producing operations, is handling several details in organizing Yale Pipe Line Co.

PAW approved construction of this project last week which will consist of 82½ miles. At the south end of the system there will be 12 miles of 6-in. from Elk Basin to a junction with the main line which is also connected with the Frannie field by 3½ miles of 6-in. From that junction, 45 miles of 8-in. extends northward to a point where a 10-mile 6-in. lateral branches to Billings and a 12-mile 6-in. lateral branches to Laurel. Capacity will be 15,000 bbl. Cost will be approximately $830,000.

Mid-Continent Connects With Norman Area Discovery Well

The discovery well of Mid-Continent Petroleum Corp. in the Norman, Okla., area on the Harris farm, is being connected with trunk line facilities in the Oklahoma City pool by a 14-mile line laid for the affiliated company, Mid-Continent Pipe Line Co.

The line consists of 7 miles of 4-in. and 7 miles of 6-in. which have been laid in 2 weeks by the contractor, Pipe Line Service Co., Seminole, Okla.

Two pumping units have been installed, one driven by a 100-hp. and the other by a 50-hp. gas engine. Capacity of the line will be 9,000 bbl. daily. In surveying for the line the Mid-Continent organization was assisted by Midwestern Engineering. The 7 miles of 6-in. was coated and wrapped.

Crude oil received at the Oklahoma City end of the line will be shipped with other oil being moved through the system of another company.

Pan American Completing Chocolate Bayou Outlet

Pan American Pipe Line Co. is completing a line from the Chocolate Bayou field, Brazoria County, to the Alta Loma field of Galveston County, Texas, which will soon start running crude from the former field. The line connects with Yount-Lee Pipe Line Co.'s carrier from Alta Loma to Pan American's refinery at Texas City. It is a 6-in. line to handle both crude and condensate from the Chocolate Bayou field and crude oil from the Alta Loma field on a joint tariff arrangement. The gathering system in the Chocolate Bayou field is composed of the old system as operated by Phillips Petroleum Co. and extensions built by Pan American to all parts of the field.

The pump station in the Chocolate Bayou field is of sufficient capacity to pump all the way to Texas City, with the Alta Loma crude being fed periodically at line pressure.

The crude and distillate from the Chocolate Bayou field has heretofore been marketed and moved out of the field by tank trucks.

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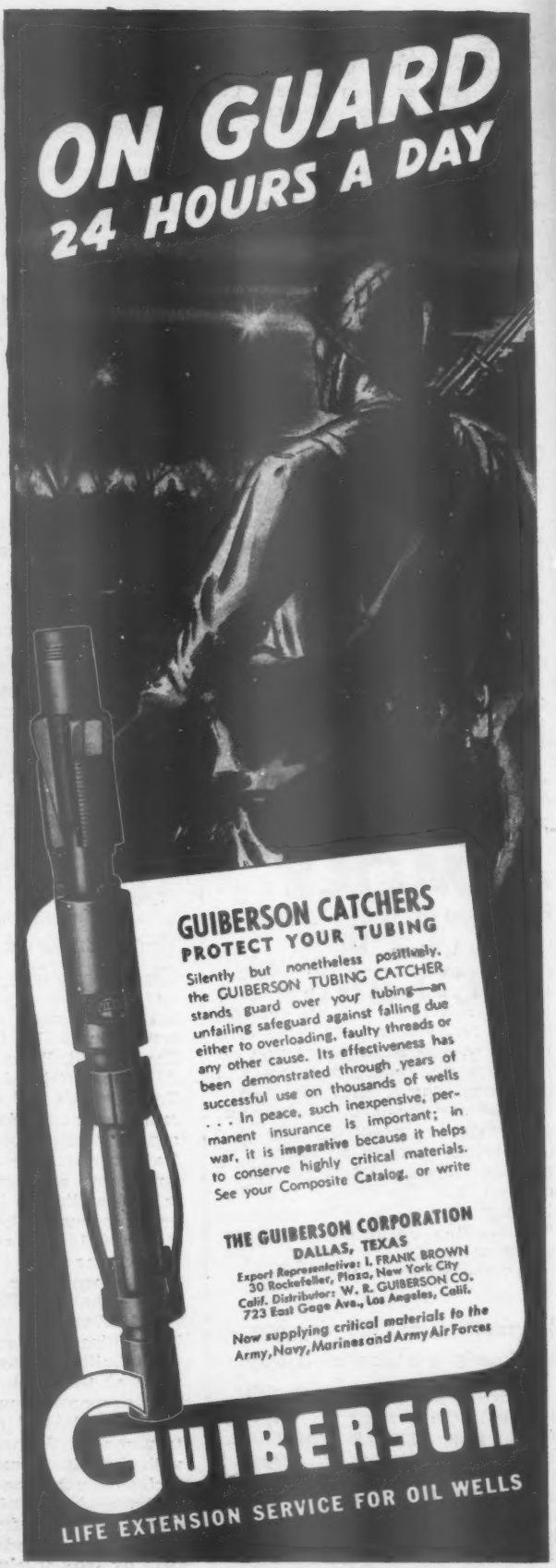
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Natural Gas

Lone Star Sells Distribution System in El Paso, Tex.

NEW YORK.—Southern Union Gas Co. has signed a contract for purchase from Lone Star Gas Co. of the latter's gas-distribution system in El Paso, Tex., for $2,700,000. Materials and supplies on hand and accounts receivable are included.

The contract, signed for Lone Star by D. A. Hulcy, president, and for Southern Union by C. H. Zachry, executive vice president.

The sale implements the agreement made by Lone Star with the Securities and Exchange Commission for disposal of its distribution system in El Paso and Galveston as part of the reorganization of the company.

Negotiations had been conducted for purchase of the property by the city of El Paso, but these were deadlocked by failure to agree on price, and apparently were dropped after El Paso voters defeated a proposition for municipal ownership of El Paso Electric Co.

Kansas Commission to Hold Hearings on Gas Fields

TOPEKA, Kans.—The state Corporation Commission has announced it will hold hearings in the Allis Hotel, Wichita, November 23, when evidence will be received to enable the commission to determine the market demand for gas produced in the Otis and Cunningham fields for December 1943 and January and February 1944, and to establish daily and monthly gas-production allowables for those months. The Otis field is in Rush and Barton counties. The Cunningham field is in Kingman and Pratt counties. All interested persons appearing at the hearings will have an opportunity to be heard.

Acquisition of Gas Properties Is Sought by Southwestern

WASHINGTON, D. C.—The Federal Power Commission will hold a hearing December 8 in Fort Worth, Tex., on an application filed by the Southwestern Public Service Co., Roswell, N. M., for a certificate of public convenience and necessity under the Natural Gas Act to acquire and operate the properties of Panhandle Power & Light Co., Cimarron Utilities Co., and Guymon Gas Co.

Panhandle Power & Light Co. gives natural-gas service in Borger and other Texas communities. Cimarron Utilities Co. serves at retail natural-gas customers in Beaver City, Boise City, Hooker and other Oklahoma communities. Guymon Gas Co. serves customers in Guymon, Okla.

Allowables Fixed for Three Texas Fields

AUSTIN, Tex.—The Railroad Commission of Texas last week fixed the November daily production allowables for three natural-gas fields as follows: Sour-gas area of the Panhandle field, 645,865,000 cu. ft.; Agua Dulce field, Dabney sand, 25,000,000 cu. ft.; Rodessa field, 41,123,433 cu. ft.

Question of Waste to Decide Attitude Toward Gas Line

AUSTIN, Tex.—Explaining his attitude toward the projected pipe line to carry natural gas from Corpus Christi to West Virginia, Gov. Coke R. Stevenson said it would be determined chiefly by evidence as to whether the gas to be exported is now being wasted. He said he would confer with members of the Railroad Commission, but did not indicate whether he would make any protest. He apparently could do nothing to prevent construction of the line, he said, in view of orders by the Federal Power Commission and the War Production Board terming it essential. Meanwhile Tennessee Gas & Transmission Co. has awarded contracts for construction of the 1,188-mile line.

The governor exhibited a letter from Richard Wagner, president of Chicago Corp. which owns Tennessee Gas & Transmission Co. in which Mr. Wagner enumerated possible effects of the export line:

Stiffening of the price of Gulf Coast natural gas; larger returns to land and royalty owners; increased tax collections for the state; greater conservation and recovery of gas now being wasted.

Mr. Wagner contended that another effect of the pipe line would be conservation of more gas, because of increased price, than is required to supply the line. He declared requirements of the line would be negligible in relation to estimated reserves of more than 40 trillion cubic feet of natural gas in the Gulf Coast area. He added that his company and affiliate have ample wells to supply the pipe-line requirements.

Big Helium Deposits Found In Western New Mexico

WASHINGTON, D. C.—Helium deposits equaling or exceeding in size those in Texas have been discovered in western New Mexico, the U. S. Bureau of Mines announces. The deposits are located on the Navajo Indian reservation near Gallup and officials said test wells had shown a very high content of helium with high pressure.

Recycling

New Plant Techniques Yield Higher Recovery of Butane

Higher recovery of butane is being achieved through new techniques in cycling plants, Karl Finterbusch, manager of the petroleum division of Stone & Webster Engineering Corp., told the Western Society of Engineers, meeting in Chicago last week. These improved methods, he said, had made it possible in some cases to recover 80 per cent butane, a primary constituent of high-octane aviation gasoline.

The new techniques were described in detail by Mr. Finterbusch. The cycling plant, he said, produces the distillate by recovering the liquid from natural gas, in the proportion of anywhere from 1 bbl. of liquid obtained from 5,000 cu. ft. of gas to 1 bbl. from 40,000 ft.

"The plant is located in terms of the pattern of wells in the producing field. It must be so placed that the pipe lines from the producing wells and the lines from the plant back into the injection wells for the return of dry gas to the reservoir are as efficient as possible. Since the dry gas must be returned to the reservoir under a higher pressure than already exists in the producing sands, high pressures are carried throughout the process. Pressures at the casing head are usually in the order of 2,500 lb. per sq. in., which is reduced and controlled at the plant to something less than 2,000 lb.

"Since the dry gas is to be compressed and returned to the formation, after separation and recovery of the desired heavier hydrocarbons, it is advantageous to keep the separator pressure high in order to reduce the required compressor horsepower. An average pressure at discharge into the injection system for return to the reservoir is in the order of 3,200 lb. pressure."

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Exploration and Drilling

Week's Highlights

THE 25 per cent increase in drilling activity charted by the Petroleum Administration for War in 1944 gives a reasonably concise pattern for future guidance of the exploration and exploitation branch of the industry. Still, success or failure of the industry in attaining the projected goal of 24,000 new wells next year, including 5,000 exploratory and 19,000 development operations, depends entirely on numerous unknown quantities.

Foremost of the contingencies, in the opinions of exploration and production department executives, is availability of equipment and manpower. Here, as in other branches of the industry, operating companies and independent producers can do much to insure their proportionate participation in the general program. PAW has assured operators that the equipment necessary to full realization of the projected completions will be available.

Simultaneously, however. PAW directors of production and materials repeatedly qualify their assurances of adequate supplies by pointing out that the entire industry must project its equipment requirements into the more distant future. Some types of equipment are, of course, more critical than others but it behoves operators to extend their requirements just as far ahead as possible and thus gain all the assurance possible that the materials will be on hand when they are needed.

The outstanding feature of PAW's 1944 drilling program is a moderate diminishment in the completion rate in Districts 1 and 4 with a bulk of the increase percentagewise assigned to District 5. Break down of the projected total of 24,000 wells calls for this distribution of completions: District 1. 4,300; District 2, 8,630; District 3, 8,545; District 4, 580, and District 5, 1,945 wells. Bulk of the completions, however, aggregating 17,175 in the PAW program, will be almost equally divided between Districts 2 and 3.

The average wildcat and development well, according to PAW figures, requires about 40.5 tons of casing, tubing and drill pipe and 13.5 tons of line pipe. It is estimated that PAW's first quarter allotments will cover about 253,000 tons of carbon steel and 52,000 tons of alloy steel. The first quarter projection of completions calls for 5,400 wells which, if past averages are maintained, will require about 218,700 tons of casing, tubing and drill pipe. Carbon and alloy steel available to the oil industry in the first 90 days of next year will total about 244,250 tons, indicating that the projected drilling program is comfortably within the availability schedule on equipment.

Prospects loom for an even greater new play for the Rocky Mountain states, involving the immense Powder River basin located in Campbell County of northeastern Wyoming and extending into southeastern Montana. Nearly every major company is well represented in working out the stratigraphy of this area. The area in Campbell County, in the center of the basin, had a number of companies holding prospecting permits under the provisions of the oil-leasing act of 8 to 10 years ago. However, these companies were forced to withdraw when the oil-leasing act was amended in 1935, changing the prospecting permits to the leasing system and imposing heavy annual rentals on large blocks in an untested area.

Now the war demand for crude shows the necessity for more discoveries, and the action of Congress in reducing royalties on discoveries of public domain to a flat 12 1/2 per cent for the duration and 10 years thereafter furnish incentives which are behind the present activity.

COMPLETIONS IN ALL FIELDS . . .

(Week ended November 13, 1943)

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1943	1942
N. Y., Penna., W. Va.	51	26	1	78	148,197	2,986	3,022
Ohio	4	7	6	17	45,803	810	998
Indiana	6	1	3	10	19,449	196	291
Kentucky	4	0	6	10	20,669	400	167
Illinois	17	0	15	32	79,468	1,536	1,585
Michigan	4	2	2	8	19,640	549	607
Kansas	23	2	24	49	160,307	1,467	1,348
Nebraska	0	0	0	0	0	26	30
Missouri-Iowa	0	0	0	0	0	17	13
Oklahoma	21	3	15	39	133,092	1,030	1,012
Texas:							
North Central Texas	14	0	9	23	69,343	1,281	938
West Texas	15	0	4	19	55,618	793	1,179
Texas Panhandle	2	2	1	5	18,087	160	304
Eastern Texas	0	0	2	2	10,816	251	353
Texas Gulf Coast	3	1	4	8	58,546	405	603
Southwest Texas	10	1	6	17	92,711	795	913
Total Texas	44	4	26	74	305,101	3,685	4,290
North Louisiana	4	7	4	15	76,319	285	424
Louisiana Gulf Coast	7	0	2	9	67,954	318	403
Total Louisiana	11	7	6	24	144,273	603	827
Arkansas	4	0	5	9	36,463	235	156
Mississippi and Southeast	0	0	0	0	0	83	54
Montana	2	2	0	4	11,523	205	176
Wyoming	1	0	0	1	3,244	119	96
Colorado, Utah	0	0	1	1	3,717	22	21
New Mexico	0	0	0	0	0	196	208
California	23	0	4	27	70,274	1,178	672
Total United States	215	54	114	383	1,207,220	15,343	15,573
Total previous week	264	28	156	448			
Week ending Nov. 14, 1942	176	39	103	318			

CALIFORNIA

Greeley Extension Well Nearing Completion

LOS ANGELES, Calif. — Standard Oil Co. will probably extend the southern limits of the Greeley field in Kern County within another week or 10 days as 1 Wegis in 21-29s-26e is in the Vedder oil sand of Miocene age at 11,600 ft. Progress for the past several days has been retarded with a fishing job resulting from the loss of a wall scraper. This outpost topped the Vedder oil sand at 11,475 ft. and on a formation test the well flowed at a daily rate of 800 bbl. of clean 35.5-gravity oil and 850,000 cu. ft. of gas through a 96/64-in. surface bean and a 24/64-in. bottom-hole bean from 11,445-11,600 ft.

Successful completion of the well at this point will open additional acreage south of the Greeley field for future drilling. It is quite possible that a condition may be found in the southern end of the field as exists in the northern end where the northwest tip of Greeley butts up against the southeastern tip of the Rio Bravo field with less than 500 ft. separating the two fields. The most remarkable feature in connection with the finding of oil sand at the south tip of the Greeley field is the fact that it is located farther out than several abandoned holes. The top at which the oil sand was found definitely indicates that the Greeley structure is coming up again and some are inclined to believe that several hundred additional acres may be found productive unless the area is complicated by faulting.

The Vedder zone as it exists in the Greeley field, although not very thick, has good permeabilities and the average porosity of this zone throughout the field is about 19 per cent. The Rio Bravo zone, also of Miocene age, has a much more favorable porosity, approximately 22 per cent, but does not exist uniformly throughout the field. The Stevens oil sand of Miocene age, first discovered by Shell Oil Co. in the Ten Section field, has failed to come up to expectations and this upper zone is now only productive at the center of the field within a limited area.

Richfield Oil Corp. is preparing to start another well in the recently discovered Tejon field in the southern end of the San Joaquin Valley.

CALIFORNIA WILDCAT COMPLETIONS

Shale Hills wildcat district, Kern County: Continental 1 Mabry, 25-26s-18e, dry, T.D. 1,992 ft.

Terra Bella wildcat district, Tulare County: Richfield 1 Adams, 29-22s-27e, dry in barren gray sand, T.D. 1,920 ft.

PERMIAN BASIN

Fullerton Pool Extended 1½ Miles Northeast

MIDLAND, Tex.—C. U. Bay et al 1 Bitler & Lowe, SW NW Section 12, Block A-32, Public School Land Survey, Andrews County, 1½ miles northeast of nearest producer of the Fullerton pool, flowed 15 bbl. per hour from lower Clear Fork pay, total depth 7,199 ft., after swabbing out oil load. The upper pay from 6,900 to 7,089 ft. was then treated with 2,000 gal. of acid, and flowed 6½ bbl. per hour. An additional treatment with 6,000 gal. of acid increased the flow to 15 bbl. per hour. The lower section from 7,089 to 7,199 ft. was then treated with 2,000 gal. and 6,000 gal., results of which have not been reported. This extension, with the southeast extension of Mid-Continent 1-B University, Section 16, Block 13 University Survey, which is now testing after flowing 6½ bbl. of oil per hour, proves up about 7,000 acres in the Fullerton pool, and should the Union pool, 3 miles northwest, be connected to it, this will be one of the larger pools in the Permian basin.

Another Clear Fork lime pool was in the making in Hockley County at Woodley Petroleum Co. 1 Harless, NW NW Section 21, Block A, R. M. Thompson Survey, total depth 5,955 ft., which swabbed from 2 to 3 bbl. of 29° oil per hour, and was preparing to acidize. Nearest Clear Fork producer is the Nairn well in Lubbock County, which has never been offset due to low production.

WEST TEXAS WILDCAT COMPLETIONS

Ector County: Forest Dev. 1-D Will P. Edwards, NW NW Sec. 33, Blk. 43-3s, T.&P. Ry. Sur., Yates 3,050 ft., frosted grains 3,080 ft., brown lime 4,140 ft., dry, T.D. 4,630 ft.

Hockley County: Globe Oil & Ref. 1 Ellwood est., 660 ft. from N & E Labor 8, League 6, Wilbarger County School Land, dry, T.D. 6,305 ft.

Pecos County: E. Russell Lloyd 1 Powell, W½ S¼ Sec. 76, Blk. 10, H.&G.N. Ry. Sur., I.P. 88 bbl., pay 1,649 ft., Yates sand, T. D. 1,661 ft. Discovery.

TEXAS PANHANDLE

AMARILLO, Tex.—Of the five completions for the Panhandle district the past week, two were oil wells with a potential of 122 bbl., and two were gas wells, with one failure reported. The failure is Shamrock Oil & Gas Co. 1 Adair, Donley County, which drilled to granite at a total depth of 5,358 ft. and plugged back to 4,792 ft. and acidized with 2,500 gal. from 4,661 to 4,709 ft. after shooting gave no results.

PANHANDLE WILDCAT COMPLETION

Donley County: Shamrock Oil & Gas 1 Adair, Sec. 15, Blk. A, J. C. Adair Sur., dry, shot 212 qt., acid 2,500 gal., 4,661-4,709 ft., T.D. 5,358 ft., granite.

SOUTHEAST NEW MEXICO

HOBBS, N. M.—Two new wildcats have been staked in the New Mexico district. In Lea County, Gordon M. Cone will drill 1 Berry-State, 1,980 ft. from the south line and 2,080 ft. from the west line of 30-18s-37e, 5 miles west of Hobbs pool and 3 miles north of production in Monument pool. It is to be a 4,000-ft. test.

Humble Oil & Refining Co. 1 Federal-Leonard, Ordovician test in 12-26s-37e, is drilling below 8,036 ft. in black shale. Skelly Oil 1-U State, prospective pool opener between West Eunice and South Eunice pools, is still cleaning out after shot.

DAILY AVERAGE PRODUCTION FOR WEEK

	Nov. 13 crude oil	Distillate, allied products	Nov. PAW quota all oils	Oct. 30 crude oil
Arkansas	78,550	4,000	81,700	78,100
California	786,750	46,000	842,000	778,300
Colorado	7,300	.....	7,000	7,100
Eastern fields	70,900	6,000	86,800	76,950
Illinois	228,350	11,500	217,600	214,675
Indiana	14,610	.....	14,000	13,325
Kansas	288,900	4,900	291,000	242,550
Kentucky	24,775	2,200	27,500	25,500
Louisiana	350,750	27,000	375,700	351,000
North Louisiana	78,600	.....	.....	78,800
Louisiana Gulf Coast	272,150	.....	.....	272,200
Michigan	60,600	100	56,100	51,850
Mississippi	52,500	.....	49,000	52,400
Montana	21,375	300	23,300	21,350
Nebraska	1,700	.....	1,600	1,700
New Mexico	112,100	5,400	116,600	112,200
Oklahoma	327,700	27,000	346,000	330,400
Texas	1,923,800	116,000	1,999,000	1,923,950
East Texas	376,400	.....	.....	376,400
West Texas	359,750	.....	.....	359,750
North Central Texas	141,900	.....	.....	141,900
East Central Texas	137,550	.....	.....	137,950
Texas Panhandle	85,500	.....	.....	85,500
Texas Gulf Coast	722,150	.....	.....	721,900
Southwest Texas	100,550	.....	.....	100,550
Wyoming	98,750	2,000	100,800	97,775
Total United States	4,449,410	252,400	4,635,700	4,379,125

Total production January 1-November 13, 1943 ..... 1,291,604,530 bbl.
Same period last year ..... 1,232,974,270 bbl.

LOUISIANA GULF

Deep Wilcox Discoveries Are Still Testing

NEW ORLEANS, La. — Although considered a major Wilcox discovery, status of the Reddell field in Evangeline Parish was still undecided, as both the prospective discovery wells continued testing. Continental and Humble's 3 Pardee Lumber Co. definitely established oil production in the perforations at 10,430-45 ft., where it flowed 53 bbl. of 38-gravity oil on 10/64-in. choke in 13 hours, tubing pressure 700 lb., casing pressure 1,050 lb. and bottom-hole pressure of 2,650 lb. Danciger, et al were preparing to try completion as a gas-condensate well in the Tate sand of the Sparta series after having conducted a number of tests in the Wilcox, one or more of which had shown possible gas-condensate production. The Continental-Humble well is now testing in sand at 10,358-70 feet and showing for gas-condensate production at this level. There is a possibility that it will be a multiple sand completion so that enough gas can be produced to supply drilling wells in the field as well as insure sufficient pressure to flow the oil from the 10,430-45-ft. level. Hearing will be necessary before this can be done.

TEXAS GULF COAST

Sand Pay Extended ½ Mile at Mayo Field

HOUSTON, Tex.—The Mayo field of Jackson County was extended ½ mile southwestward by Humble Oil & Refining Co. 9 Maggie Branch, C. Culina Survey 14, A-101, 660 ft. out of the northeast corner of the survey. It was flowing 6 bbl. an hour through ⅛-in. choke, tubing pressure 700 lb., and preparing to run potential, in perforations at 5,402-10 ft. This is in the regular 5,400-ft. pay sand. Total depth is 6,502 ft., plugged back to 5,442 ft.

Great Lakes Carbon Corp. of New York, in its first venture in the Texas Gulf Coast district, was preparing to spud before November 14 the 1-C A. W. Brownson, 1¼ miles south of production at West Garwood field in Colorado County, and 2,100 ft. southwest of the 1 H. C. Carpenter dry hole. This wildcat is in Asa McClure Survey on the 356-acre Brownson "C" lease. Great Lakes Carbon Corp. is buying W. R. Davis' leasehold interests in the West Garwood area and the 1-C Brownson is being drilled to protect the Brownson 356-acre tract on which lease would have expired 11-14-43.

Humble Oil & Refining Co. prepares to start another Wilcox wildcat in the Warren area of Tyler County, the 1-C C. E. Goolsbee, 100.2-acre lease in the J. B. Flieller Survey A-903, 1.7 miles northwest of Warren townsite which puts it a little more than a mile southeast of the 1-B Goolsbee, an 8,424-ft. dry hole drilled earlier this year.

TEXAS UPPER GULF COAST WILDCAT COMPLETIONS

Brazos County: J. Elmer Thomas 1 Milo heiss, 2½ mi. E NE of Millican townsite dry at 4,813 ft.

San Jacinto County: Navarro Oil Co. 1 Roberts Co., wildcat 3 mi. SW of Shepherd townsite, dry at 9,257 ft.

ROCKY MOUNTAIN

Powder River Basin May Be Next Major Development

DENVER, Colo.—The extensive wildcat play in the Big Horn basin, northern Wyoming, which followed the discovery of oil in the Tensleep horizon in the Elk Basin field a year ago, appears to be spreading "over the hill" into the enormous Powder River basin in the northeastern part of the state. The last named is not only much larger than the basin from which it is separated by the Big Horn mountain range, but is practically virgin territory. It covers an area approximately 90 miles wide by 120 miles long, and extends from the Big Horn Mountains on the west to the Black Hills on the east, and from the Laramie range and the Hartville uplift on the south into southern Montana. The depression is covered by formations of Tertiary age which lie uncomformably on older beds and make surface geology of comparatively little value.

Subsurface structural conditions have to be determined by geophysical surveys and at this time there are at least seven gravity meter and four seismograph crews in the basin working out the stratigraphy and searching for promising highs. The Gulf Oil Corp., the Shell Oil Co., the the Carter Oil Co. each have two crews, one gravity meter and the other seismograph, and Barnsdall Oil Co., Amerada Petroleum Co., Texas Co., Superior Oil Co., and Sinclair-Wyoming Oil Co. each have one crew working in the basin.

The Powder River basin is similar in some respects to the Big Horn basin in that oil fields have been found around the rim, but practically no exploration has taken place on possible structures out in the basin. One reason for this was that in the earlier days the most promising horizons were believed to be too deep for drilling, and another was due to most of the land belong to the public domain and the difficulties arising out of changes in the oil-leasing regulations.

MONTANA WILDCAT COMPLETIONS

Ingomar, Rosebud County: Northern Ordnance, Inc. 1 Hillison, C NE SE 23-9n-35e, T.D. 5,814 ft. in Madison, plugged back to 4,119 ft., perforated at 3,755 ft., acid 3,000 gals., ran 349 ft. 5½-in. liner at 3,770-4,119 ft., completed in Amsden at 3,910-4,030 ft. for 8,200,000 cu. ft. of gas, 1,000 lb. pressure.

Kevin-Sunburst, Toole County: Henry Vander Pas 4 Zachor, SE NE SW 20-35n-1w, T.D. 1,524 ft., Ellis-Madison contact 1,522 ft., acid 500 gal., 28 bbl. initial on pump.

South Shelby, Toole County: Nadeau Bros. 1 State, CEL NE SW 36-32n-3w, T.D. 1,320 ft., est. 2,000,000 to 3,000,000 cu. ft. of gas from sand at 1,315-20 ft.

COLORADO WILDCAT COMPLETION

South Douglas Creek, Superior Oil Co. 1 fee, NE NE SE 12-4s-102w, T.D. 7,917 ft., dry and abandoned after testing Sundance.

APPALACHIAN FIELDS

Three Deep Wildcats Nearing Completion

PITTSBURGH, Pa. — In Mercer Township, Butler County, Manufacturers Light & Heat Co. is drilling at 6,498 ft. in the wildcat on the J. W. Hockenberry farm with the Newburg horizon placed at 6,250 ft. and no gas, oil or water. The present formation is the red Clinton, and the white Clinton is expected within the week.

Fayette County. — On Chestnut Ridge in Wharton Township, Fayette County, Greensboro Gas Co. is drilling 4 Barton at 7,150 ft. with a gage of 1,250,000 cu. ft. of gas from the Onondaga chert beds. In South Union Township, New Penn Development Co., William E. Snee et al are drilling at 7,378 ft. in 3 Heyn, which is being deepened below the Oriskany to test for gas in the upper part of the Silurian, which, due to an unexpected thickening, has not yet been reached.

OHIO, KENTUCKY

Good Gasser Extends Morgan County Field

ZANESVILLE, Ohio. — The Brush Creek field was extended ½ mile to the south by the Ohio Fuel's Delmer Woodward well in Section 3, Deerfield Township, Morgan County. The well gaged 2,630,000 cu. ft. from the Clinton sand found at 4,049-79 ft. Another well is drilling 2 miles to the south in an endeavor to further extend the field.

Industrial Gas Corp. completed a

55-bbl. well in the Thornville pool, which has been inactive for some time. The well was on the Harvey Long tract in Section 13, Thorn Township, Perry County.

The Clayton pool had one completion this week, an 84-bbl. well on the Jacob Keffer tract in Section 4, completed by Preston Oil Co.

The Hinckley and Wellington pools each had a gas completion on inside locations. These pools are active with one or more completions a week.

OHIO WILDCATS

Coshocton County, Jackson Township: South Penn Oil 1 Allen McCoy, Sec. 18, Clinton 3,702-53 ft., dry, T.D. 3,919 ft.

WESTERN KENTUCKY

OWENSBORO, Ky. — Four less-than-average oil producers and six dry holes were reported from western Kentucky fields during the week.

WESTERN KENTUCKY WILDCAT COMPLETIONS

Union County: Kingwood 1 A. F. Lilly, ¼ mi. SW of Morganfield, dry at 2,802 ft., Penn sand at 980-82 ft., shot, production ¼ bbl. of oil, ¼ bbl. water.

Henderson County: Sinclair Prairie 2 T. L. Chandler, swabbed 72 bbl. oil, 36 bbl. water, Waltersburg sand 1,813-17 ft., and Hardinsburg 2,040-48 ft., T.D. 2,055 ft.

INDIANA

EVANSVILLE, Ind.—Wildcat failures in Gibson and Posey counties, both drilled to the St. Louis limestone, were reported in the past week, together with a 70-bbl. well, Superior Oil Co. 2 E. Thompson unit, NE SW NE 25-2s-12w, producing from Cypress sand at 1,966-70 ft., and a 165-bbl. well, J. E. Bauer 1 West, S½ N½ 27-1n-10w, producing from McClosky lime at 1,766-70 ft.

INDIANA WILDCAT COMPLETIONS

Gibson County: Phillips Petroleum 1 Ed. Naas, NW NE NW 36-3s-11w, dry at 2,341 ft. Base of Pennsylvanian 1,469 ft., Menard 1,487 ft., Cypress 1,953 ft., Ste. Genevieve 2,198 ft., St. Louis 2,338 ft.

Posey County: Sinclair-Wyoming 1 Adolph Grein, C NE SE 24-8s-14w, dry at 2,704 ft., Glen Dean 2,040 ft., Ste. Genevieve 2,551 ft., St. Louis 2,685 ft.

Harrison County: Harrison Development 1 Hayes, C NE NW 36-3s-3e, dry at 826 ft.

Spencer County: W. B. Bateman 1 J. Ernst, SE NW SW 8-6s-4w, 5 bbl. per day. Jackson sand 796-803 ft., T.D. Two miles from nearest production.

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ILLINOIS

Completions Fall Behind New Operations in State

CENTRALIA, Ill. — Seventeen new oil wells and 15 dry holes were completed in Illinois during the week and 44 new operations were started, including 7 wildcats in Wayne, Jefferson, Franklin, Clinton, Washington and Shelby counties.

One wildcat uncovered production in White County, A. J. Slagter and C. Partee 1 Sefried, NW SE SW 30-3s-11e. It had Biehl sand at 1,850-60 ft., total depth 2,400 ft., and pumped 44 bbl. of oil and 10 bbl. of water initially.

Texas Co. deepened 17 J. Friesner in the Salem pool in Marion County from 3,372 ft. to 4,597 ft. to test Devonian and Trenton limestones. It got a 30-bbl. producer from the Devonian and 10 bbl. initial output from the Trenton. The largest initial producers of the week were Pure Oil Co. 1 Klinginsmith, C NE SE 25-3n-8e, Clay City pool. It flowed 872 bbl. in 24 hours from McClosky lime at 2,979-82 ft.; Cities Service Co. 1 Creighton, NW SE SE 21-2s-9e, East Barnhill pool, Wayne County, flowed 711 bbl. oil and 20 bbl. water from McClosky lime at 3,323-34 ft. and Cherry & Kidd 3 F. J. Wright, SW NE NE 15-8s-10e, Gallatin County, pumped 384 bbl. initially from Waltersburg sand topped at 1,938 ft. Tar Springs sand at 2,038-52 ft., and Cypress sand topped at 2,364 ft.

ILLINOIS WILDCAT COMPLETIONS

Brown County: E. Corliss 1 Clark, NW SW SE 17-1n-3w of fourth principal meridian, dry at 373 ft.

Clinton County: Shell 1 F. Nollen, NE SE SE 21-2n-1w, dry at 1,318 ft., Cypress sand 1,290 ft., Weiler sand 1,298 ft.

Rea & Richardson 1 Jantzen, SE SW SE 29-2n-2w, dry at 1,265 ft., Benoist sand 1,254 ft.

Effingham County: Kiowa Drilling 1 Landenburg, SE SE NW 35-7n-6e, dry at 2,816 ft., Glen Dean 2,309 ft., Cypress 2,383 ft., Benoist 2,532 ft., Aux Vases 2,594 ft., McClosky 2,761-67 ft.

N. E. Dexter et al 1 Brumleve, SE SE NW 17-8n-7e, dry at 2,653 ft., Menard

1,870 ft., Cypress 2,242 ft., Benoist 2,379 ft., Aux Vases 2,450 ft., McClosky 2,565-68 ft.

Jasper County: Helmerich & Payne 1 Charles Hovey, C NE NE 22-5n-10e, dry at 3,007 ft., Menard 2,134 ft., Cypress 2,566 ft., Fredonia 2,904 ft.

Fayette County: Buell & Doran 1 Stine, SW SW SE 21-6n-2e, dry at 2,009 ft., Tar Springs 1,467 ft., Cypress 1,744 ft., Weiler 1,774 ft., Benoist 1,892 ft., Aux Vases 1,928 ft., Ste. Genevieve 2,002 ft.

Hancock County: Dale Hopkins 1 Slater, NW SE NW 20-4n-5w, of fourth principal meridian, dry at 673 ft., St. Louis lime 71 ft., Salem 93 ft., Warsaw 115 ft., Keokuk 174 ft., Burlington 194 ft., Devonian 620 ft., lower Devonian 659 ft.

Wayne County: C. F. Frazier 1 Mary Fannin, C SE NW 22-2s-6e, dry at 3,401 ft., Menard 2,442 ft., Aux Vases 3,201 ft., McClosky 3,330-45 ft.

White County: A. J. Slagter and C. Partee 1 Sefried, NW SE SW 30-3s-11e, pumped 44 bbl. oil and 10 bbl. water from Biehl sand at 1,850-60 ft., T.D. 2,400 ft. Pool opener.

Great Lakes 1 F. Reiling heirs, NE SW SW 22-6s-10e, dry at 3,012 ft., Cypress 2,630 ft., Aux Vases 2,911 ft., Ste. Genevieve 2,961 ft.

Mid-States and Ashland 1 Nichols, SE SE SE 11-3s-10e, dry at 2,569 ft., Kinkaid lime 2,123 ft., Waltersburg sand 2,51_ ft., Tar Springs 2,544-69 ft.

McBride, Inc., 1 Ladora, NW SE SW 6-4s-14w, dry at 2,945 ft., Menard 2,007 ft., Cypress 2,695 ft., Benoist 2,836 ft., Aux Vases 2,929 ft.

MICHIGAN

22 New Permits to Drill in A Week of Few Completions

SAGINAW, Mich.—New production dropped off sharply again in Michigan oil field activities with but nine completions being reported for the week, resulting in two small producers in Van Buren County, an inconsequential wildcat and the biggest well of four, an Allegan County well pumping 140 bbl. a day; in addition, there were two dry holes and two small gas wells, including a 1,200,000-cu. ft. wildcat completion in the Fork Township oil field of Mecosta County. The wildcat oil well, averaging but 2 bbl. a day in Logan Township, Mason County, resulted from deepening of a test begun early last year.

Considerable new development was indicated for Osceola and Mecosta counties as the state Conservation Department issued 22 new drilling permits for tests in 12 counties to boost the permit list for the year to 522. Five of the new permits are for Osceola, four for Mecosta, two each for Allegan, Newaygo, and Van Buren, the others for single tests in Bay, Sanilac, Clinton, Genesee, Arenac, Clare and Isabella counties.

MICHIGAN WILDCAT COMPLETIONS

Allegan County, Monterey Township: P. K. Degenther 2 Anton Church, NW SE NW 2-3n-13w, dry in Traverse limestone, T.D. 1,687 ft.

Mason County, Logan Township: Walhalla Oil Co. 2 G. H. Young et al, NW SE NW 9-17n-15w, pumping 2 bbl., acidized. T.D. 3,303 ft.

Mecosta County, Fork Township: Leslie T. Barber 2 State, NW SE SE 2-16n-7w, 1,200,000 cu. ft. gas, T.D. 1,497 ft.

EASTERN TEXAS

Pittsburg Field May Be Extended 1 Mile

DALLAS, Tex.—Oil stains and odor were encountered from 8,036-43 ft. in H. S. Moss 1 Claud Williams, Williams Survey, 1 mile southwest of producers in the Pittsburg pool of Camp County, indicating a possible extension to the pool. The test shows favorable structural position in topping Paluxy sand at 5,660 ft., and had massive anhydrite from 7,151-7,335 ft., with top of the Travis Peak not reported. Since the discovery well was was completed in July 1940, there have been but five additional wells drilled in the Pittsburgh pool with an average daily production of 390 bbl. At present there is one other active test in the field, Gulf Oil 1 C. C. Garrett, which topped Glen Rose at 5,930 ft. and is now drilling below 7,000 ft.

Franklin County.—Heavy rig has

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been installed on Humble Oil & Refining 1 Hogue, 1 mile southwest of Winfield, on the Titus County line, and the test will definitely be carried to the Smackover lime.

Wood County.—Sun Oil Co. 1 Scoggins, Burch Survey, southwest extension to Manziel pool, was running casing after drilling to 6,631 ft. in shale and sand. After passing up good oil sand from 6,312-60 ft., the test hit water sand at 6,414 ft., and topped Glen Rose at 6,610 ft.

EAST TEXAS WILDCAT COMPLETION

Henderson County: Continental Oil et al 1 Ella Warren, 330 ft. from N, 1,500 ft. from E, J. P. Lambright Sur., Woodbine 4,648 ft., dry, T.D. 4,816 ft.

SOUTHWEST TEXAS

Upper Sand Zone Flows Oil in Extension Well

CORPUS CHRISTI, Tex.—Opening of a new oil pay sand about 1 mile south-southeast of nearest production at the Slick-Wilcox field in Goliad County featured development in the Southwest Texas district last week. The new producer, Frank and George Frankel 1 Schroeter, was brought in as an oil well in the uppermost sand zone, which shows gas in the main part of the field. However, it ran about 200 ft. lower than the highest wells in the field and may be across a graben or fault from other producers. The new production is from perforations at 7,660-63 ft. where it made 26-gravity oil through ⅛-in. chokes on preliminary tests, and was preparing to run potential. Total depth of the hole is 9,007 ft., 5½-in. casing was set to 8,010 ft.

Victoria County.—Northern Ordnance Co. 1 Heath, wildcat 1 mile north of Mission Valley, in extreme northwestern Victoria County, near De Witt County line, blew out from a shallow sand at 4,900 ft. but was controlled successfully and operator was conditioning mud to run electric log. This is a proposed 10,000-ft. test with Wynn Crosby Drilling Co. of Houston, the contractor.

Zapata County.—George H. Echols is going ahead in the 1 Volpe estate, about 8 miles east of Zapata, Share 1, Porcion 32, after having been shut down at 6,580 ft. for rig repairs. It is now scheduled to be carried to about 7,500 ft. Operator is said to have about 7,200 ft. of casing on the location and it appears likely that a test will be made of sands above 6,500 ft., even though it does not find deeper showings.

Gonzales County.—Casing has been set in Amerada Petroleum Corp. and Alder Oil Co. 1 Morgan & Junetka, wildcat about 12 miles south of Gonzales in the S. B. Conley Survey. Casing was set to about 6,575 ft. after the test had been scheduled for abandonment at total depth of 6,726 ft. Decision to test was made after a study of the electric log and samples.

Jim Hogg County.—The recently opened Armstrong field of Jim Hogg County was further limited last week when Humble Oil & Refining Co. abandoned the 3 Strohman, 1,650 ft. southwest of Texas Co. 1 Armstrong discovery well, total depth 3,927 ft.

LaSalle County.—Charles E. Fraser, Inc. of Dallas was rigging up 1 D. C. Reed, new wildcat about 6 miles southwest of the Washburn field, to test the Wilcox zone. This new wildcat is 467 ft. from south and west lines of 160-acre lease, being the northwest quarter of H.&G.N. Survey 159, and is on acreage worked up by William H. Spice of San Antonio. Arkansas, Stanolind and Transwestern are said to be supporting the test.

LOWER GULF COAST WILDCAT COMPLETION

Jim Wells County: Texas Gulf Producing Co. 1 Jarvis E. Miller et ux, 2 mi. SE of Orange Grove townsite, dry at 6,014 ft.

SOUTH TEXAS WILDCAT COMPLETIONS

Live Oak County: Henderson Coquat 1 McFall M. Kerbey, 7 mi. NE of Oakville, dry at 8,029 ft.

Cebb County: Holland Oil Co. and Frank J. Gravis 1 E. T. Laubscher, 4 mi. NW of Callaghan, dry at 5,008 ft.

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LA.-ARK.

Travis Peak Gas Well Opens Northwest Ruston

SHREVEPORT, La.—A new gas pool was brought in last week in Lincoln Parish at Arkansas Louisiana Gas Co. 1 Giles. Location of the well, which is 3 miles northwest of the old Ruston gas area, lies 12 miles northeast of the Simsboro gas pool and some 15 miles east of the Sugar Creek oil and gas pool of Claiborne Parish. Gas was found in the Travis Peak zone at 5,878-96 ft. With ¼-in. chokes at top and bottom, it flowed gas in 6 minutes. On open-flow test it made 50,000,000 cu. ft. of dry gas at a bottom-hole pressure of 2,100 lb. and a rock pressure of 2,400 lb.

ARKANSAS WILDCAT COMPLETION

Clark County: R. L. Fisher 1 Ross, NE NE SW 23-10s-21w, dry T. D. 2,178 ft.

NORTH LOUISIANA WILDCAT COMPLETIONS

Caddo Parish: H. L. Carnahan 1 Glasell-North, SW NE SW 26-20n-15w, dry, T. D. Nacogdoches 774 ft., Paluxy 2,256 ft.

Catahoula Parish: Jim McMurry 1 Marks, NE NE 11-9n-8e, dry, T. D. 4,605 ft.

Lincoln Parish: Arkansas Louisiana Gas Co. 1 Giles, NW NW SE 19-19n-2w, dry, T. D. 5,985 ft., Pettit 5,165 ft.

Ouachita Parish: Westgate-Greenland 1 Lewis Werner, SE SW 9-17n-2e, dry, T. D. 6,020 ft., Wilcox 1,305 ft., Tokio 3,282 ft., Paluxy 3,765 ft.

Tensas Parish: Youngblood & Foree 1 Ayers Timber Co., SE SE 21-14n-10e, dry, T. D. 4,500 ft.

MISSISSIPPI

JACKSON, Miss.—Gulf Refining Co. was preparing to test the 1 G. S. Stanley, 34-10n-9w, in the Eucutta field. Total depth was 6,838 ft. in shale and lime, with 7-in. casing set at 6,836 ft. This well topped Marine Tuscaloosa 6,250 ft. found oil and salt water shows in the Davis sand, had good oil recovery from drill-stem test at 5,100-38 ft. and will probably try for completion in this upper sand.

FLORIDA

HOUSTON, Tex.—Humble Oil & Refining Co. is lowering all casing strings in the 1 Gulf Coast Realties Co., wildcat in 29-48s-30e, Suniland area of Collier County, Florida. A flow of salt water developed between the casing strings, resulting in the decision to lower the pipe, bringing the oil string closer to bottom of the hole, after which pipe will probably be perforated for another test. Tests have been under way in open hole from 11,613-26 ft. for several weeks and several hundred barrels of 19-gravity oil have been swabbed out of the hole along with considerable emulsion and water. The 7-in. casing is set at 11,598 ft. Total depth is 11,630 ft.

Dade County—W. G. Blanchard 1 Everglade, wildcat 100 ft. N and 200 ft. E of SW corner of section 31-53s-35e, which had been temporarily abandoned in November 1942, is now being drilled deeper below 6,020 ft. in lime. Old total depth was 3,086 ft. in lime.

ALABAMA

Washington County—Humble O. & R. Co. 1 C. D. Scott, wildcat in section 28-8n-4w, is drilling below 6,720 ft. sand and shale.

CANADIAN FIELDS

Production Increased at Turner Valley Extension

CHATHAM, Ont.—Promising to open a new area to the east of production, Major Oils 6, LSD 2, 8-21-3w5, finished at 8,713 ft. with Madison limestone at 8,238 ft., is making large production from the upper porous after the lower zone was cemented off because of water. After acidizing with 2,700 gal. the well tested 17 bbl. an hour, settling to 15½; but a further 2,000 gal. brought it up to 65 bbl. an hour on a 5-hour test, with 650 lb. pressure on the casing.

Jumping Pound.—Canada's deepest well, Shell-Exploration-Norman 1, LSD 5, 22-24-5w5, on the Jumping Pound structure west of Calgary, finished in black lime at 12,056 ft. after drilling 465 ft. of Madison limestone. Thickness to the black lime approximated the normal Turner Valley log. Electrolog and directional surveys are being taken to help determine whether to run a liner from the end of the casing to bottom and make production tests in the lime.

Fort Norman. — No official figures have been made public of crude production from the Fort Norman field since June. Production for the 6 months of 1943 up to June 30 totaled 89,929 bbl. compared with 9,674 bbl. for the same period of 1942. The official figures do not represent, however, the present potential of the field, as a large proportion of the completed wells are capped pending completion of the pipe line to Whitehorse, and the continuance of drilling operations will have resulted in a number of new producers since the end of June. Drilling operations are being handled by Imperial Oil, in conjunction with the U. S. Army, though Imperial, it is understood, has nothing to do with other phases of the larger Canol project, including the building of roads and air bases and the construction of the pipe lines and refinery. The refinery will, it is stated, be operated by Standard Oil Co. of California. The U. S. Government is underwriting the direct expense incurred by Imperial Oil in development, but will be recouped in a reduction of 50 cents per barrel in the price of oil, after the first 1,500,000 bbl. The initial price is to be $1.25 a barrel. While detailed figures on completions and production in the Fort Norman field are withheld, it is admitted the field has proven much larger than anticipated, both in its superficial extent and in its productivity.

KANSAS

Completions and First Reports Rise Sharply

COMPLETIONS, as well as first reports, were up last week in Kansas. There were 49 wells finished of which 23 were oil wells and 2 gassers. Fifty permits were taken out for new wells, of which 13 were wildcats.

McPherson County.—Adair & Morton 1 Paden, a wildcat in SW SW SE 10-18-1w, found pay in the Mississippian chat at 2,752-70 ft. The hole filled with oil and flowed 40 bbl. and after acid treatment pumped 400 bbl. of oil in 14 hours. The well is within ½ mile of dry holes drilled to the east and west of it and the prospects of its becoming an extension to the Roxbury and Henne pools, about 3 miles to the north, will depend on the outcome of offset wells. Its production of 400 bbl. is a large well for chat production.

KANSAS WILDCAT COMPLETIONS

Barton County: Continental and Darby 1 Drehle, NW NW SW 28-19-14w, dry, T.D. 3,608 ft., Arbuckle 3,558 ft.

Dickinson County: Jones & Hill 1 Lauxman, SE NE NE 31-16-1e, dry, T.D. 3,688 ft., Mississippi lime 2,651 ft.

Ellis County: Phil-Han 1 Falconberry, SE SE NW 3-11-19w, dry, T.D. 3,615 ft., Kansas City 3,242 ft., Lansing 3,263 ft.

Marion County: Frank Dieter 1 Seildert, NE NE SE 16-20-5e, dry, T.D. 2,157 ft.

McPherson County: John Allison 1 fee, NW NW NE 20-18-3w, dry, T.D. 3,671 ft., Viola 3,533 ft., Arbuckle 3,652 ft.

Adair & Morton 1 Paden, SW SW SE 10-18-1w, pumped 400 bbl. in 14 hr., Mississippian chat 2,752-70 ft.

Aladdin Pet. 1 Methodist Church, NW NW SE 14-18-1w, dry, T.D. 2,813 ft., chat 2,791 ft.

Rice County: Danciger 1 Rice, NW NW NW 34-18-8w, dry, T.D. 3,276 ft., Viola 3,310 ft., Arbuckle 3,421 ft.

Rooks County: Bridgeport Oil 1 Triplett, NW NE SW 5-8-20w, dry, T.D. 3,534 ft., Kansas City 3,176 ft., Arbuckle 3,504 ft.

Bridgeport Oil 1-B Renner, NW NW NE 31-9-20w, dry, T.D. 3,997 ft., Kansas City 3,591 ft., Arbuckle 3,963 ft.

Russell County: Hough Davis 1 Funk, NW NE NW 26-12-14w, dry, T.D. 3,397 ft., Viola 3,296 ft., Arbuckle 3,339 ft.

Appleman and National Ref. 1-B Kaufman, NW NW SW 23-15-12w, est. 150 bbl., sand 3,258-76 ft.

Stafford County: Marlyn Oil 1 Jenkins, W½ SW NW 2-25-12w, dry, T.D. 4,175 ft., Viola 3,976 ft., Arbuckle 4,133 ft.

Sedgwick County: Westgate-Greenland 1 Siewert, SW NW NW 4-27-3w, dry, T.D. 4,325 ft., Arbuckle 4,274 ft.

N. CENTRAL TEXAS

New Marble Falls Lime Pool in Young County

WICHITA FALLS, Tex.—Anderson-Prichard Oil Corp. 1 Myers and Walsh, G. W. Walsh Survey, 1½ miles northwest of Murray, in southwestern Young County, has opened a new Marble Falls lime producing area for North Texas. The well drilled to 4,858 ft. in dry Ellenburger, topped at 4,657 ft., and plugged back to test the Marble Falls at 4,246 ft. The first 20 perforations from 4,242-39 ft. showed no results, but the next 20 shots from 4,254-49 ft. caused the hole to fill with oil in 4 minutes, and when the well was opened it flowed 88 bbl. in 2 hours through ¼-in. choke. The new strike is 2 miles southeast of the Murray pool and a like distance northwest of the Latimer test which made a small well. Small shows of oil from Marble Falls lime have been encountered in dry holes drilled in the vicinity.

Clay County. — Shell Oil 1 R. F. Wynn, Rooney Survey, west of Bellevue, which promised to open a new Mississippi lime pool at 6,174 ft., was drilling at 6,716 ft. after passing top of Simpson at 6,435 ft. and top of the Ellenburger at 6,706 ft., with no oil shows reported.

Cooke County. — The Winger area of the Walnut Bend pool was given a southeast spread of one location at Magnolia Petroleum 3 Percy McGeorge, Block 72, Fannin County School Land Survey, which perforated at 5,537-60 ft. with 110 shots and flowed 83.92 bbl. of oil in 3 hours. Over a thousand acres have been added to the pool since discovery of the Winger sand in January of this year.

NORTH CENTRAL TEXAS WILDCAT COMPLETIONS

Archer County: Albert Crenshaw 1 C. E. Carter, 926.7 ft. from N, 1,063.6 ft. from E, Lot 21, Clark & Plumb subd., Blk. 5, 4 mi. SE Archer City, dry, T. D. 1,154 ft.

J. L. McMahon 1 I. C. Elmore, 1,000 ft. from N, 2,000 ft. from W, Lot 29, Blk. 5, Clark & Plumb subd., dry, T. D 1,186 ft.

R. R. Robertson 1 C. L. Abercrombie, 1,420 ft. from S, 100 ft. from W, Sec. 152, J. W. Harris Club Ranch subd., dry S.S.O. 1,233-36 ft., T.D. 1,236 ft.

White & Duncan 1 Lorean Kinder, 330 ft from E, 330 ft. from S, Lot 111, Blk. 4 Clark & Plumb subd., dry, T.D. 1,266 ft.

Montague County: H. F. Gibson 1 W. L. Boland, 766 ft. from S, 640 ft. from W, Sec. 1, B.S.&F. Sur., 8 mi. E Nocona, granite 4,041 ft., dry, T.D. 4,053 ft.

Young County: Fleming Oil Co. Fleming-Kimbell 1 M. K. Graham, O.W.W.O., 467 ft. from S & W, NE¼ Sec. 2,912, T.E.&L. Sur., 8 mi. SW Newcastle, I.P. 75 bbl., Marble Falls pay 4,253-69, ft., Mississippi lime, 4,585 ft., Ellenburger 4,803-4,927 ft., P.B. to 4,300 ft. from T.D. 4,927 ft.

WEST CENTRAL TEXAS

ABILENE, Tex.—A new pool from the Flippen lime was indicated for northern Taylor County at Lewis Production Co. 2 Teaff, SE SE Labor 9, League 122, W. R. Willis Survey, 1½ miles north of Dunigan pool. The new strike, ½ mile south of 1 Teaff, which had a small show of oil but was abandoned at 2,755 ft., filled 1,000 ft. with 46-gravity oil from saturated Flippen lime topped at 2,295 ft., and will be deepened a few more feet and then acidized for completion.

Another wildcat for Coleman County was staked by W. W. Harvey at 1 McCord, SW SW Section 20, McCord & Linsey Survey, ½ mile north of a dry hole which had an encouraging show of oil. The new wildcat is to go below 3,000 ft.

WEST CENTRAL TEXAS WILDCAT COMPLETION

Haskell County: Humble Oil & Ref. 1 H. Wiltbanks, 660 ft. S & W NW cor. Sec. 5, Blk. 14, H.&T.C. Ry. Sur., but in Georgetown Ry. Sur., NW part county, elev. 1,553 ft., S.S.O. 5,007-11 ft., dry, T.D. 5,992 ft.

OKLAHOMA

State Oil Men Are Watching Cleveland County Test

OKLAHOMA operators were waiting on word from Mid-Continent Petroleum Corp.'s prospective pool discovery in Cleveland County, which was being made ready for testing. Pipe was set to 8,792 ft. and the plug drilled Monday.

In the meantime, southern Oklahoma was adding a number of new large wells. Attention was again focused on the Medrano sand sector of the West Cement pool where Ray Stephens 1 Pohlemann, NE NE NW 33-6n-10w, was drilled deeper to 6,105 ft. and reported some 100 ft. of saturated sand. On a 12-hour test it flowed at the rate of 70 bbl. an hour. This well is farther west than any in the area. To the east of the 1 Pohlemann, Magnolia Petroleum Co.

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WILDCATS AND DISCOVERIES

NINE new oil wells, 4 gas wells and 68 dry holes made up the week's total of 81 wildcat completions.

Kansas reported the two largest wells. In McPherson County, Mississippian chat production was extended about 3 miles south of the Roxbury and Crowther pools by a 400-bbl. well. This discovery, however, is offset by dry holes on the east and west to within ½ mile but may open a long narrow strip to connect with the chat pools to the north. This area enjoyed a drilling boom about a year ago and a new well of this size, comparatively large for chat production, will undoubtedly encourage additional drilling. The other Kansas discovery, estimated good for 150 bbl. a day, is in the big Trapp and Kraft-Prusa area and is a southwest extension to the Dubuque pool of Russell County.

In Lincoln Parish of North Louisiana, a large gas well was brought in for an open-flow test of 50,000,000 cu. ft. a day. Gas is coming from the Travis Peak zone at 5,878-96 ft. The location is about 2 miles northwest of the old Ruston gas pool.

WILDCAT COMPLETIONS

	Week ended November 13, 1943					Cumulative total for 1943				
	Oil	Distillate	Gas	Dry	Total	Oil	Distillate	Gas	Dry	Total
Ohio	0	0	0	1	1	4	0	21	52	77
Indiana	1	0	0	3	4	4	0	0	52	56
Kentucky	1	0	0	1	2	20	0	2	108	131
Illinois	1	0	0	12	13	67	0	3	358	428
Michigan	1	0	1	1	3	11	0	2	140	153
Kansas	2	0	0	12	14	54	0	1	323	378
Nebraska-Missouri-Iowa	0	0	0	0	0	0	0	0	24	24
Oklahoma	0	0	0	8	8	39	1	17	234	291
Texas:										
North Central	1	0	0	6	7	51	0	1	314	366
West	1	0	0	2	3	11	0	1	75	87
Panhandle	0	0	0	1	1	0	0	0	6	6
East	0	0	0	1	1	5	0	2	91	98
Gulf Coast	0	0	0	7	7	6	7	6	109	128
Southwest	0	0	0	5	5	21	11	4	238	274
Total	2	0	0	22	24	94	18	14	833	959
Louisiana:										
North	1	0	1	4	5	6	0	4	64	74
Gulf Coast	0	0	0	0	0	12	7	1	28	48
Total	0	0	1	4	5	18	7	5	92	122
Arkansas	0	0	0	1	1	2	0	0	57	59
Mississippi and Southeast	0	0	0	0	0	5	0	0	58	62
Montana	1	0	2	0	3	5	0	3	23	31
Wyoming	0	0	0	0	0	6	0	0	15	21
Colorado, Utah	0	0	0	1	1	0	0	1	5	6
New Mexico	0	0	0	0	0	5	0	2	22	29
California	0	0	0	2	2	7	0	9	124	140
Total United States	9	0	4	68	81	341	26	80	2,520	2,967
Total previous week	6	0	0	72	78					

completed its 2 Edwards in the sand at 5,764-5,834 ft. Flowing through ½-in. choke on tubing, it made 1,260 bbl. in 18 hours. Three other completions at Cement made 220, 453 and 1,060 bbl. a day.

In the Doyle pool of Stephens County, Phillips Petroleum Co. 1 Craven, NE NE SW 11-1n-5w, was a dual completion. Perforations at 5,412-29 ft. resulted in 10,000,000 cu. ft. of gas a day and additional shots at 6,202-31 ft. produced a flow of 425 bbl. of oil, the latter in the Hefner sand.

OKLAHOMA WILDCAT COMPLETIONS

Creek County: W. A. Knappenberger 1 Dumas, SE SW NE 2-16n-8e, dry, T.D. 3,217 ft., Bartlesville 2,825 ft.

Garfield County: Ingling & Parker et al 1 Kring, NE SE SW 12-21n-3w, dry, T.D. 4,279 ft., Layton 4,259 ft.

Lincoln County: J. J. Fleet 1 Stevens, NW SE 3-15n-6e, dry, T.D. 3,584 ft., Oswego 2,934 ft., Bartlesville 3,340 ft.

Mdi-Continent Pet. 1 McKeown, NE NE SW 9-16n-5e, dry, T.D. 4,432 ft., Viola 4,335 ft.. Wilcox 4,427 ft.

Noble County: Northern Ordnance 1 McCoy, SE NW SW 24-23n-2w, dry, T.D. 4,892 ft., Layton 3,602 ft., Wilcox 4,815 ft.

Oklahoma County: L. S. Youngblood 1 Swatik, NW SW 7-11n-4w, dry, T.D. 8,650 ft., Bartlesville 7,690 ft., Hunton 7,775 ft., Viola 8,240 ft., second Wilcox 8,624 ft.

Pawnee County: McMillin Pet. 1 Etna Life, SW SE 10-22n-4e, dry, T.D. 3,473 ft., Bartlesville 3,425 ft.

Stephens County: Hall-Briscoe 1 Edwards, SW SE NE 4-3s-6w, dry, T.D 2,304 ft.

CRUDE-OIL PRICES

Representative selected crude prices from all sections of the country appear below:

East Texas	$1.28
Conroe	1.43
Tepetate, Louisiana	1.18
Illinois basin	1.37
Pecos County, Texas	.98
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas*	1.00

*No change since 5-21-41.

Gravity Schedules

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Texas	West Texas*
18-18.9	$0.80	....	....	
19-19.9	.84	....	$1.06	$0.79
20-20.9	.88	$0.85	1.08	.73
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.83
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.09	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.13

*Includes Lea County, New Mexico.

Geologists to Hold Annual Convention in Dallas

The twenty-ninth annual convention of the American Association of Petroleum Geologists will be held March 22 and 23, 1944, in Dallas, Tex. The Society of Economic Paleontologists and Mineralogists will hold their yearly meeting jointly with the geologists, and the Society of Exploration Geophysicists will hold a concurrent meeting. A. Roger Denison, Amerada Petroleum Corp., Tulsa, is president of the A.A.P.G.

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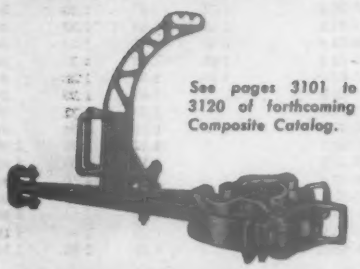

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Among the Drilling Contractors

Bell & Loffland completed a wildcat discovery well for Richfield in the Tejon district of Kern County, California.

Glassell Drilling Co., Shreveport, La., has the contract to drill Continental Oil Co. and Humble Oil & Refining Co. 4 Pardee Lumber Co. in the Reddell area of Evangeline Parish, Louisiana. It is a scheduled 12,000-ft. Wilcox test 18-4s-1w.

Rocky Mountain Drilling Co. is drilling Standard Oil Co. of California's potential discovery well on the Wegis property at the extreme southern end of the Greeley field in Kern County, California.

San Joaquin Drilling Co. is making good progress repairing Continental's 1 Meyer in the Wasco, California, field but it may be another several weeks before this deep well is back on production again. The Meyer well, which was producing from 13,138 ft., went to water several weeks ago.

Loffland Brothers will drill Phillips Petroleum Co. and Tide Water Associated Oil Co. 1 F. A. Godchaux, Sr., in the Intra-Coastal City area of Vermilion Parish, Louisiana. This wildcat is in 88-14s-3e.

Nicklos Drilling Co., Houston, Tex., is rigging up at Continental Oil Co. 3 Acadia Parish School Board, westerly offset to the 1 Acadia, north flank discovery well, at North Richie in Acadia Parish, Louisiana. The new test is in 16-7s-1w, and is scheduled for 8,600 ft.

Apex Drilling Co., Fort Worth, Tex., is drilling an Ellenburger test for Hanlon Gasoline Co. on the east edge of the Breckenridge field, Stevens County, Tex., located in Section 25, Block 5, Texas & Pacific Railway Survey. On completion of this test, the firm will move to northeast Throckmorton County and drill a wildcat for Bruce Sullivan.

O. W. Dyer, Houston, Tex., who has been drilling for Atlantic Refining Co. in the Neale field of Beauregard Parish, Louisiana, for the past several years, has the contract on Atlantic's most recent location in the area, the 4-E Rice Land and Lumber Co., in NW¼ 33-3s-11w. It is a 12,000-ft. Wilcox test.

J. R. Sharp, Tulsa, has just completed as a dry hole, Globe Oil & Refining Co. 1 Ellwood estate, total depth 6,305 ft., located in northeast corner Labor 8, League 6, Wilbarger County School Land Survey, Hockley County, Texas.

T. P. Pike Drilling Co. has been awarded a contract to drill a wildcat on the Title Insurance & Trust Co. property for Richfield Oil Co. in the San Fernando Valley district of California.

J. R. Sharp Drilling Co. will establish headquarters office at Midland, Tex.

Muskegon Development Co. has been awarded the drilling contract on Regal Dutch Petroleum Co. 1 Nickolas and Henrietta Dykhuis, NW SW NW 2-4n-15w, Allegan County, Michigan.

J. W. Spencer will drill John F. Burton 1 Mulligan, NE NW SW 25-9n-8e, Genesee County, Michigan.

Ashby Drilling Co. has the drilling contract on Gulf Refining Co. 1 Kuochel-Swantek, C N½ SW SE 35-

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Manning & Brown, Denver, Colo., with more than 25 rigs running, is one of the most active drilling-contracting firms operating in the Rocky Mountain area. In the picture, taken in front of the company's office and shops at Powell, Wyo., are shown, left to right: Robert King, assistant truck superintendent, Powell; G. N. English, transportation superintendent, Casper, Wyo.; Bud Bovee, office manager, Powell; E. E. Brown and Fred M. Manning, owners, and Carl Krueger, drilling superintendent, Denver

15n-4e, Bay County, Michigan. Ashby will also assist in drilling C. L. Maguire, Inc., and H. H. Coffield 1 H. Hibma, in C S½ NW NE 2-20n-8w, Osceola County, Michigan.

Union Rotary, Inc., has the contract to drill Cities Service Oil Co. 1 Floyd Methner, C SE½ SW NW 33-16n-3w, Isabella County, Michigan.

Lupher Drilling Co. has been awarded drilling contract on two wells Pure Oil Co. will drill in Newaygo County, Michigan. These are the 1 Fredenburg Consolidated, C E½ SW SW 5-14n-11w, and the 1 A. S. Madison, C E½ NE SW 5-14n-11w.

Two States Drilling Co. will drill two tests for Ohio Oil Co. in Osceola County, Michigan. These are the 4 William Howe, SE SW SW 31-19n-9w, and the 3 William Howe, C S½ NW SW 31-19n-9w.

Markley-Bankhead has the contract for the Royal Petroleum 1 Canebreak, a 10,000-ft. test in 1-7n-10e, Concordia Parish, Louisiana.

R. A. Wells has contract on Prudential Oil & Gas Corp. 1 James Schnapp-Wylie Wright, C 19-11n-4w, Bay County, Michigan.

Comanche Drilling Co., Blackwell, Okla., has just finished a well for Hooper-Byrne Co., of Wichita, Kans., in SW¼ 7-34-6e, Cowley County, Kansas, setting oil string at 2,920 ft., and are moving rotary rig to 5 miles east and 1½ miles south of Blackwell, Okla., for the C. A. Leonard estate, of Blackwell.

Delta Drilling Co. is erecting derrick and preparing to rig up for a new wildcat in the Pineland prospect of Sabine County, Texas. Location is in the SW¼ of Block 5, Ben Linsey Survey, about 11 miles from Hemphill. The test, which will be carried to 8,000 ft., will be known as the Delta 1 Pineland-Ridge estate.

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PERSONALS

R. E. FOSS

Barnsdall's General Manager Rose From Rotary Helper

R. E. FOSS, who was recently appointed general manager of operations for Barnsdall Oil Co.'s Pacific Coast division, started his career in the oil industry as a rotary helper in 1932 after graduating from California Institute of Technology, Pasadena, Calif., with a degree in mechanical engineering.

He gained experience in drilling and producing operations in varied assignments during the next 3 years and, in 1935, joined the Barnsdall organization. He became foreman in 1936 and a year later was promoted to district drilling engineer at Elwood. He became chief drilling engineer in all districts of the Barnsdall company's Pacific Coast division in 1941.

Mr. Foss was appointed engineer in charge of all construction work in January 1943, and held that position until he was again promoted and given the title of general manager last September.

Cary P. Butcher is in charge of offices opened this week in Midland, Tex., as headquarters of a West Texas-Southwest New Mexico district established by Richfield Oil Corp., whose main offices are in Los Angeles, Calif. Mr. Butcher, who has resided in Midland 9 years, was chief district geologist for Tide Water Associated Oil Co. until he resigned to become an independent operator. **George R. Gibson,** district geologist in the new Richfield office, was a member of the Magnolia Petroleum Co.'s staff until about 2 months ago, when he gave up that connection to join Mr. Butcher.

G. B. Nelson, Jr., has been made unitization supervisor of Stanolind Oil & Gas Co., in Tulsa, working under **G. B. Jenkinson, Jr.,** manager of the land department.

R. W. Gallagher, president of the Standard Oil Co. (New Jersey), has accepted appointment as chairman of the petroleum group of the National War Fund New York Committee in its current campaign for funds.

Felix McCurdy, compressor-station superintendent for Lone Star Gas Co. in Gainesville, Tex., was voted that city's "most outstanding citizen for 1943" in recognition of his service as leader of the third war-loan drive, in which $1,489,000 worth of bonds were sold, $112,500 above the city's quota.

William Averill, independent oil operator of Corpus Christi, Tex., will succeed **D. E. Buchanan** as director in charge of District 3, Petroleum Administration for War, with offices in Houston, Tex. Mr. Buchanan, who joined the PAW staff in Houston January 1, 1941, has resigned.

Cecil Hutchens, for the past 5 years a scout for Skelly Oil Co. in the Ardmore, Okla., Mattoon, Ill., and Evansville, Ind., areas, is now an independent operator in the Evansville field.

A. J. Renaud, who has been in charge of the Houston, Tex., offices of Hunt Oil Co., went to Midland, Tex., last week to supervise removal of the Houston offices to Midland. He will superintendent operations of the company in West Texas. It is expected that the concern, whose headquarters are in Dallas, Tex., will acquire extensive holdings in the Permian basin.

W. C. Kelly has been made vice president and general manager of Snowden & McSweeney Co., which has acreage and leaseholdings in the Mid-Continent and Southwest and a natural-gasoline plant in Bridgeport, Ill. Mr. Kelly suceeds **J. P. Shannon,** who retired last month. His headquarters will be in Fort Worth, Tex.

Milton Cooke, petroleum engineer with the Railroad Commission of Texas in Houston for the past year, has resigned to accept a position with Crown Central Petroleum Corp. in Houston. Mr. Cooke graduated from Texas A. & M. College, and has been connected with the oil industry since 1935.

Ernest Allen, Jr., engineer for Phillips Petroleum Co. at Kaw, Okla., has been transferred to Blanket, Tex.

Carl M. Hill, formerly assistant field supervisor in the production department of Lone Star Gas Co., Dallas, Tex., has been promoted to assistant chief production engineer. **Minor O. Attebery, Jr.,** was made field supervisor, succeeding **J. W. Burrage,** who resigned. **Austen J. Hargrave,** district production engineer at Coleman, Tex., was transferred to a similar post in the East Central Texas district, previously held by Mr. Attebery. **Neiman C. Smith,** production engineer in the West Central Texas district, takes the place of Mr. Hargrave.

R. C. Ward, formerly in the Houston, Tex., office of Superior Oil Co., has been made district manager of the company's northern Middle West area, with headquarters in Evansville, Ind.

R. W. Hirsch, formerly a junior engineer for Shell Oil Co., Inc., in the Tulsa office, has been transferred to Skellytown, Tex.

Lt. Edwin S. Coppage, on leave as an employe of Shamrock Oil & Gas Corp., Sunray, Tex., recently returned from foreign duty in the U. S. Field Artillery and now is stationed at Fort Benning, Georgia.

Tom McMahon, independent oil operator, formerly located in Tulsa, is now established in Carmi, Ill.

Gail F. Moulton, recently engaged in oil-producing operations and consulting work in Lawrenceville, Ill., has joined the department of petroleum economics of Chase National Bank, New York, where he will have charge of the department's geological work. After leaving the Illinois Geological Survey 15 years ago to go into commercial work, Mr. Moulton served as manager of the geological department of United Gas Co. in Houston, Tex. He left to become staff geolo-

gist in New York for Electric Bond & Share Co. in 1931. From 1937 to 1940 he was in charge of the New York office of Ralph E. Davies, Inc., and he moved to Illinois in 1941.

Fred A. Warren, assistant chief engineer of Ohio Oil Co., pipe-line department, Findlay, Ohio, has gone to Washington, D. C., on leave of absence to serve as an associate of **D. F. Sears,** chief of the pipe-line engineering section of the Petroleum Administration for War. His task is analyzing applications for new construction presented by pipe-line companies and passing on their importance. Mr. Warren, who received his engineering degree from Iowa State College, joined Illinois in 1939. During his absence his place will be filled by **Charles A. Firmin,** assistant chief engineer at the Robinson, Ill., refinery of Ohio Oil Co.

James D. Ball, formerly assistant district superintendent for Humble Oil & Refining Co. in the Kelsey field, Starr County, Texas, has been promoted to district superintendent. **Jeremiah Ward III,** formerly a petroleum engineer in Humble's Houston, Tex., office, has been transferred to Galveston Bay, Texas, as district petroleum engineer.

Richard C. McCurdy, who has been on special assignment in Washington, D. C., has completed his work and has returned to Shell Oil Co., Inc., as chief exploitation engineer working out of the Los Angeles, Calif., office.

F. H. Skehan, New York, has been elected a vice president and director of Colonial Beacon Oil Co. Mr. Skehan has been manager of the Virginia division of the company since 1935. He joined Standard Oil Co. of New Jersey 37 years ago as a clerk.

Fred H. Townsend, formerly assistant superintendent of gasoline plants for Lone Star Gas Co. and Lone Star Producing Co., has been advanced to superintendent, replacing **Harry Wheeldon,** who resigned to take a position with Shamrock Oil & Gas Corp. in Amarillo, Tex. **John M. Kindle,** of Ranger, where he was superintendent of gasoline plants in the West Texas district, takes the post formerly held by Mr. Townsend, and both men will have offices in the Lone Star headquarters in Dallas, Tex. Both are graduates of Texas A. and M. College and hold degrees in chemical engineering. Mr. Townsend joined Lone Star in 1927 as a testing engineer. Mr. Kindle entered Lone Star service in 1926 as a chemist. **Chester R. Rogers** has been named superintendent of West Texas plants, and his place as assistant superintendent of the West Texas area has been filled by **J. A. Bates,** superintendent of the Brooks plant at Breckenridge. Succeeding Mr. Bates at Breckenridge is **Joe Francis,** superintendent of Lone Star's gasoline plant at Gordon, Tex. **H. C. Wells,** superintendent of the gasoline plant at Hollis, Okla., replaces Mr. Francis at Gordon. **Joe M. Phillips,** assistant superintendent of Hollis plant, has been named plant superintendent, and **Roy M. Helm,** chief engineer, becomes assistant superintendent of the Hollis plant.

W. W. Porter, independent geologist, has joined the Reserves Division of PAW and will make his office at the headquarters of District 5 in Los Angeles. Mr. Porter at one time did some exploration work for Standard of Indiana in Mexico and later was employed by O. C. Field Gasoline Co. and Western Gulf Oil Co. He completed a geological survey on the Island of Cebu prior to the advent of war.

Gen. Howard L. Peckham has been appointed director of the fuels and lubricants division, Office of the Quartermaster General, Army Service Forces, Washington, D. C., the War Department announced last week. He succeeds **Brig. Gen. William E. R. Covell,** who has been given an unannounced assignment.

Gardiner Symonds, vice president of Chicago Corp., is president of its new subsidiary, Tennessee Gas & Transmission Co., which is to operate a pipe line from Corpus Christi, Tex., to Charleston, W. Va. Other changes in connection with the pipe-line project include election of **Fred H. Fues,** formerly assistant secretary and treasurer of the parent company, to a vice presidency in the same organization. He will have his offices in Corpus Christi as head of the company's oil and gas division. **Richard K. Cartlidge,** previously secretary of the company, was chosen treasurer. **R. G. Rice,** assistant secretary of Chicago Corp., will also hold the corresponding post in the subsidiary. **H. K. Greenleaf,** formerly landman for Phillips Petroleum Co. in Corpus Christi, is now head of the land department of Chicago Corp. **W. E. Mueller,** of Corpus Christi, is transferred from the parent company to treasurer of the subsidiary. **W. C. Norman** is shifted from the parent organization to assistant to the president of the pipe-line company. **H. N. Severs,** of Corpus Christi, is made production superintendent in the Saxet district. **Harold Burrow,** of Corpus Christi, formerly purchasing agent for the corporation in Corpus Christi, is shifted to the same position in the pipe-line company. **Wayne Colley,** of Alice, Tex., becomes purchasing agent of Chicago Corp. **D. B. McNamara** is named comptroller of the oil and gas division of Chicago Corp., with **Ed Smith,** of Chicago, as his assistant.

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Market Developments

East Coast

NEW YORK.—An indication of the heavy drain on East Coast petroleum supplies was given last week in a report from the Allied headquarters in North Africa showing that of 9,440,000 tons of cargo landed at North African ports to the middle of October, 4,072,000 tons, more than 43 per cent, consisted of petroleum products. It was further stated that between one-fifth and one-sixth of that total was aviation gasoline.

In spite of that drain, the supply situation on the East Coast continues to show marked improvement. This is shown in a comparison on the indexes of the available supply of various products:

Product—	Index No. Nov. 6	Index No. Oct. 16	Change
Gasoline	36.9	34.2	+2.7
Kerosene	53.7	51.0	+1.7
Gas oil	56.7	50.5	+6.2
Residual fuel	79.9	83.4	—3.5

Most significant conclusions to be drawn from this comparison are: (1) The dangerously low position of gasoline inventories; (2) the substantial improvement in gas oil and distillate stocks, products now entering their season of heaviest demand; and (3) a moderate decline in residual fuel-oil stocks indicating that the chances of the decline in high-gravity product prices spreading to low-gravity material are not immediate.

Several developments of the past week clarified the East Coast situation somewhat. These included issuance of summaries of recent changes in commercial-consumer tank-wagon gasoline prices by OPA which had been requested by a confused trade, the fixing of ceilings on bulk lots of gasoline, kerosene, gas oil and distillates shipped from specified midwestern points into District 1 and simplification of the gasoline-rationing plan by increasing the value of B and C coupons issued after December 1 from 2 to 5 gal.

Gulf Coast

HOUSTON, Tex. — Substantial improvement in the coastwise and export movement of crude oil and petroleum products continued this week, although improvement of the marine transportation situation precipitated an even tighter condition in motor-fuel supplies.

Gulf Coast refiners, as a group, are converted more completely to war production than any other similar concentration of manufacturing capacity, leaving a minimum of material dependent on the civilian market. Consequently, the calls for regular motor fuel are being turned away as a matter of routine business.

Slack in the fuel-oil market, a factor in operations during the early fall months, has been virtually removed by increased consumption by railroads and preparations to ship distillate burning oils through WEP lines.

Mid-Continent

ADVENT of colder weather in various areas quickened interest in the heating oils this week, but relatively few refiners in District 2 have more than adequate working stocks, with the result that buyers did some shopping around. Off-specification material, which could be moved with difficulty in normal times, was said to be finding ready sale. There was no haggling over minor deficiencies in end point or flash. Offerings of high cold-test material, however, continued to elicit lukewarm interest owing to the trouble which attends handling it in low temperatures.

Increasingly acute shortages of gasoline were reported. Refiners said they were forced to refuse all new accounts and to cut down long-established ones ruthlessly. Illustrating how business is being turned away as a result of depleted supplies, one refiner mentioned an account which regularly took 300,000 gal. of gasoline monthly. "We had to shave it down to 150,000 gal. this month," he said.

Lubricating oils, with the exception of neutrals, were firm to tight. The reason for the exception, refiners explain, is that neutrals play a far less important role in the making of lubricants than formerly. In the manufacture of a lubricating oil much of the bright stock formerly used had S.A.E. viscosity of 150 at 210° F. It required more neutral to cut back that bright stock to the proper S.A.E. viscosity than it does to cut back the present production of bright stock with a viscosity of 100 to 120 at 210° F.

A.P.I. REFINING REPORT

Week Ended November 6, 1943

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Stocks: Residual	Stocks: Gas oil
Appalachian	145	2,429	371	1,140
Ind., Ill., Ky.	715	13,202	3,117	6,809
Okla., Kan., Mo.	329	6,395	1,256	2,460
Censored area*	2,055	30,694	18,719	22,207
Rockies	198	1,102	718	459
California	727	14,676	39,368	11,901
Total 11- 6-43	4,079	68,498	63,551	44,776
Total 10-30-43	4,176	69,297	63,838	44,591
Total 11- 7-42	3,690	76,335	79,057	49,793

*Reports combined on East Coast, Texas Gulf, Louisiana-Arkansas and Inland Texas at request of PAW.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
November 6, 1943	236,937,000
October 30, 1943	237,219,000
November 7, 1942	236,198,000

*Excludes unrefinable California stocks.

Pacific Coast

LOS ANGELES, Calif. — Elimination of the 10 per cent restriction placed on the manufacture of premium gasoline and substitution of lower octane motor fuels gave California marketers a new lease on life. The 10 per cent limitation had already resulted in elimination of Wilshire's Polly gasoline and several other premium grades and would have eventually resulted in total elimination of all quality grades due to transportation and proration difficulties. The Pacific Coast has been a quality market for several months during which third-grade gasoline has been practically eliminated.

OPA recently recognized an important marketing factor in California when it allowed refiners to add transportation costs to the established refinery base price. This has had a tendency to increase gasoline prices in the spot market about 1 cent per gallon as most sales are made on a delivered basis. This increase of approximately 1 cent per gallon has resulted in a selective market and has severely reduced what little trading has been done in recent weeks. Resumption of premium sales may revive trading activities due to a wider margin but if gasoline rations are reduced to 2 gal. weekly, as has been intimated, there won't be any spot market left.

Service station shutdowns are increasing again and present indications are there will be considerably fewer stations in operation at the close of the present year. Obviously if the ration is reduced to 2 gal. weekly only the strongest will survive even though increased coupons are allowed to defense workers.

Refinery Prices

(Prices as of November 15, 1943)

Quotations are f.o.b. plant in cars and in cents per gallon except where otherwise noted. They are exclusive of the federal excise taxes of 1.5 cents a gallon on gasoline and 4.5 cents a gallon on lubricating oils, and do not include marine lighterage charges.

REFINERY GASOLINE

Octane (A.S.T.M.):	80†	74-76	70-72	68-70	63-66
Mid-Continent*			6.000		5.625
Pennsylvania		6.750-7.000			
Gulf Coast	6.00-6.50		§5.750-6.250	§5.750-6.250	§5.250-5.750
Northeast Coast	9.80		9.2	9.2	
California	6.750-7.500	6.250-6.500	6.125-6.250	5.750-6.125	5.125-5.500

*Basis Group 3. †1939 C.F.R. (research method). §Unleaded.

KEROSENE AND NO. 1 FUEL OIL

Gravity:	46	45	42-44	41-43	38-40
Mid-Continent*			4.500	4.375	
North Louisiana				4.500-4.750	
Pennsylvania	6.250-6.625	6.125-6.250			
California				4.500-5.500	4.250
Northeast Coast				6.80	
Gulf Coast				4.125	

*Basis Oklahoma Group 3.

TRACTOR, DIESEL, AND BUNKER FUEL OIL

Specifications:	46-48° G.	34 D.I.	48-52 D.I.	58 & above	Diesel bunkers	Residual Bunker C†
Mid-Continent*	4.125					$0.80-1.27
California		2.750-4.000			‡1.35-1.45	1.10-1.15
Gulf Coast			4.000	4.125	1.45	0.85-1.27
Northeast Coast				6.800	2.780	1.65-2.07
North Louisiana						0.80-1.27

*Basis Oklahoma Group 3. †Gravity range ‡Pacific Specification 200.

FURNACE OIL, GAS OIL, FUEL OIL

	No. 2	No. 3	No. 5	No. 6
Mid-Continent*	3.625	3.500	$0.85	$0.80
Pennsylvania (West)	5.875-6.125	5.875-6.000	†5.250-5.500	
Northeast Coast	6.7	6.7	1.95	1.65
California	5.5	5.5	‡1.10-1.25	§1.10-1.15
Gulf Coast	3.750-3.875		1.35	0.85

*Basis Oklahoma Group 3. †36-40 gravity fuel. ‡Pacific Specification 300. §Pacific Specification 400.

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	4.750	5.700
North Texas	4.375	5.250
North Louisiana	4.375	5.250
California	4.875	5.500

LUBRICATING OILS

Bright and Steam Refined

OKLAHOMA (Group 3)—

200-210 D, 10-25	27.00
150-160 D, 0-10	23.00
120-125 D, 0-10	22.00
Steam refined:	
600 dark green (untreated)	9.00

PENNSYLVANIA—

Bright Stocks (Pennsylvania Grade No. 8 color, 140-150 at 210, 545-550 flash)

10 pour point		30.50
15 pour point		29.50
25 pour point	25.00	23.00
Steam refined:		
600	15.00	16.00
650	15.50	16.50
600 flash	16.00	17.50
630 flash	17.00	17.50

Neutral Oils

Vis. at 100° F. (except Pennsylvania and color N.G.A.)

OKLAHOMA (Group 3)—

0-10 pour point:	
200-3	15.00
300-3	18.00
500-3	19.50
600-3	20.00

Note: Viscous neutrals, 10-25 pour, quoted 0.5 cent under 0-10 oils.

CALIFORNIA—

200-2½-3	7.00	7.75
400-3-4	7.25	8.00
600-3-4	8.75	11.00

Neutral Oils

200-4-5	7.00	7.75
400-5-6	9.00	11.00
500-900, 5-6½	9.25	11.25

GULF COAST—

Pale oils:		
200-3	8.50	8.75
300-3	9.00	9.25
500-3½	9.75	10.00
750-3½	10.00	10.25
2,000-4	10.50	10.75
3,000-4	12.25	12.50

PENNSYLVANIA—

150 vis. at 70° F., 3 color, 400-405 flash:	
Zero pour point	37.50
10 pour point	36.50
15 pour point	35.50
25 pour point	30.00
200 vis. at 70° F., 3 color:	
Zero pour point	39.50
10 pour point	38.50
15 pour point	37.50
25 pour point	32.00

WAX

(Cents per pound)

OKLAHOMA (Group 3)—	
124-126 (A.m.p.) w.s. scale	4.250
PENNSYLVANIA (inland refineries)—	
122-124 (A.m.p.) w.c. scale	4.250
124-126 (A.m.p.) w.c. scale	4.250
NEW YORK—	
Wax in bags fully refined:	
130-133 (A.m.p.) wax	5.850
133-135 (A.m.p.) wax	6.150
Crude scale:	
124-126 (A.m.p.) w.s.	4.250
124-126 (A.m.p.) y.s.	4.250

TANK-WAGON PRICES IN 50 CITIES

(Gasoline prices based on regular grades, tax included, undivided dealer)

ATLANTIC AND NEW ENGLAND

(Socony-Vacuum Oil Co., Inc., and Atlantic Refining Co.)

	Dealer tank wagon	Combined tax	Kero. tank wag.
Baltimore, Md.	15.95	5.50	10.50
Boston, Mass.	14.90	4.80	10.10
Burlington, Vt.	16.90	5.50	10.20
Buffalo, N. Y.	16.20	5.50	10.90
Dover, Del.	16.70	5.50	12.30
Hartford, Conn.	15.60	4.50	10.00
Manchester, N. H.	17.20	5.50	12.10
Newark, N. J.	15.20	4.50	10.00
New York, N. Y.	16.10	5.50	10.10
Philadelphia, Pa.	16.20	5.50	11.90
Pittsburgh, Pa.	16.70	5.50	12.30
Portland, Me.	16.50	5.50	10.20
Providence, R. I.	15.00	4.50	9.90
Washington, D. C.	15.20	4.50	11.30
Average 14 cities	16.02	5.14	10.85

(All prices undivided dealer basis.)

CENTRAL

(Standard Oil Co. of Indiana, Standard Oil Co. of Ohio, Continental Oil Co. and Texas Co.)

	Dealer tank wagon	Combined tax	Kero. tank wag.
Chicago, Ill.	14.10	4.50	10.80
Cleveland	15.00	5.50	*9.00
Dallas, Tex.	13.00	5.50	7.00
Des Moines, Iowa	14.40	4.50	10.10
Detroit, Mich.	14.40	4.50	10.00
Fargo, N. D.	16.90	5.50	11.60
Huron, S. D.	16.30	5.50	11.00
Indianapolis, Ind.	15.60	5.50	10.10
Little Rock, Ark.	17.50	6.00	10.00
Milwaukee, Wis.	16.10	5.50	10.80
Minneapolis, Minn.	15.90	5.50	10.00
Omaha, Neb.	15.40	6.50	9.80
Tulsa, Okla.	16.50	7.00	8.50
Wichita, Kans.	13.30	4.50	8.70
Average 14 cities	17.46	5.57	9.84

*Includes 1-cent state tax.

SOUTHEASTERN

(Standard Oil Companies of New Jersey, Kentucky, and Louisiana)

	Dealer tank wagon	Combined tax	Kero. tank wag.
Atlanta, Ga.	18.90	7.50	*11.50
Birmingham, Ala.	18.50	6.50	9.00
Charleston, S. C.	18.95	7.50	....
Charleston, W. Va.	19.25	6.50	13.30
Charlotte, N. C.	20.10	7.50	11.30
Jacksonville, Fla.	18.50	6.50	9.50
Jackson, Miss.	17.50	7.50	†9.00
Louisville, Ky.	16.50	6.50	8.50
Memphis, Tenn.	17.90	6.50	10.30
New Orleans, La.	17.75	6.50	10.00
Norfolk, Va.	17.45	6.50	12.30
Average 11 cities	18.34	7.50	10.50

*Includes 1-cent state tax.
†Includes ½-cent state tax.

MIDWESTERN

(Continental Oil Co.

	Dealer tank wagon	Combined tax	Kero. tank wag.
Albuquerque, N. M.	17.50	7.50	10.00
Boise, Idaho	20.10	6.50	16.50
Casper, Wyo.	17.00	5.50	12.00
Denver, Colo.	14.50	5.50	11.00
Helena, Mont.	17.00	6.50	13.00
Phoenix, Ariz.	18.50	6.50	12.50
Reno, Nev.	17.50	5.50	13.50
Salt Lake, Utah	18.50	6.50	14.50
Average 8 cities	17.58	6.25	12.88

PACIFIC COAST

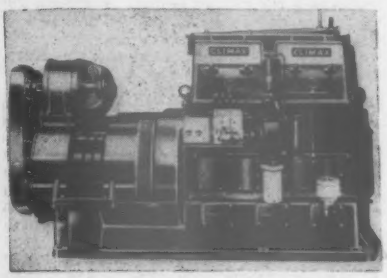
(Standard Oil Co. of California)

	Dealer tank wagon	Combined tax	Kero. tank wag.
Portland, Ore.	17.00	6.50	13.50
San Francisco, Calif.	14.50	4.50	11.50
Seattle, Wash.	17.00	6.50	13.50
Average 3 cities	16.17	5.83	13.03
Average 50 cities	16.50	5.96	10.92

Equipment Progress

Climax Begins Production Of Diesel Engines

The production of two solid injection, compression ignition engines has just been announced by Climax Engineering Co., of Clinton, Iowa. These prime movers are additions to the company's extensive line of Blue



Streak gas engines, 8 to 480 hp., generating sets, 300 watts to 312 kva., and complete accessory equipment.

Both new engines are four-cycle, full diesels and intended for use as light plants and primary drives for pumps, compressors, mills, mine equipment, marine service, etc.

Model D148 is a two-cylinder unit with a maximum rating of 22 hp. It may be equipped for pulley drive with or without clutch or clutch and reduction gear or auxiliary power takeoff. As a diesel electric plant it may be direct connected, on a single base, with a 15-kva. generator.

Model D297 is a four-cylinder unit with a maximum rating of 44 hp. Drive equipment similar to Model D148 may be furnished. A special feature of D297, however, is that a flywheel, clutch, generator, generator or marine gears may be installed on either or both ends, providing a radiator is not used. For electric power and light, the D297 may be used to power a 30-kva. generator.

Gates Rubber Given Army-Navy Production Award

On August 29 in a colorful ceremony at the Denver City Auditorium the men and women of Gates Rubber Co. were awarded the Army-Navy "E" pennant for high achievement in war production. The presentation was made by Col. Merle H. Davis, chief of the St. Louis ordnance district, and was accepted by Charles C. Gates, president of Gates Rubber Co. "E" lapel insignias were presented by Capt. Frank H. Roberts, U.S.N., (reserve) commanding officer all naval units, University of Colorado, and accepted by W. E. Blakley, president Local 154, URWA-CIO. Gov. John C. Vivian, of Colorado, acted as master of ceremonies.

Trade Literature

Toledo Pipe Threading Machine Co., Toledo, Ohio.—A 60-page catalog on the company's line of pipe tools, power pipe machines, vises and benches. The catalog has a handsome four-color cover and is profusely illustrated.

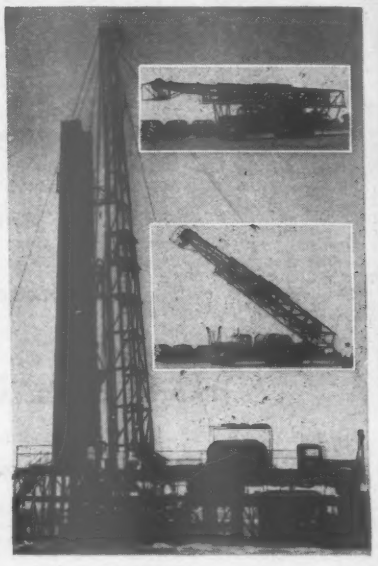
McCord Radiator & Manufacturing Co., Detroit, Mich.—A very elaborate story on the new American helmet, which the firm developed and produced as their contribution to the war effort. Copies available on request.

Franks Self-Propelled Double-Duty Telescoper

Containing all of the essentials for either drilling or servicing wells and mounted on a single truck, the Model 7000 double duty "self-propelled" telescoper made by the Franks Manufacturing Corp., Tulsa, brings added savings to the petroleum industry.

A Model 7000 now in service at Riverdale, Calif., contains a 96-ft. derrick, draw works, power plant, rotary table, crown block, stacking board as an integral part of the unit. Pumps for drilling operations are mounted on skids for handling by an auxiliary truck.

The Franks derrick telescopes to 58 ft. for over-the-road travel with blocks and lines strung, reducing move-in and rig-up time to usually less than 45 minutes. Actual raising, extending and locking the derrick require less than 10 minutes. A patented power screw raising and lowering mechanism and a self-locking device feature the Franks unit. The derrick is equipped for handling rods and racking drill pipe or tubing.



Franks Model 7000 double duty "self-propelled" telescoper in service in California with 7,900 ft. of 2½-in. tubing racked. A substructure is used here to clear the elevated blowout preventer. Insets show unit in over-the-road position and with derrick being raised

Among Equipment Men

Refinery Supply Co. Celebrates Silver Anniversary

Refinery Supply Co. of Tulsa and Houston is observing its twenty-fifth anniversary this fall. In commemoration of this occasion they are distributing a most attractive brochure entitled "An Occasion of Appreciation." It contains a chronicle of world history since 1918, featured largely by outstanding events in the petroleum industry for the last quarter century, with comments on the part Refinery Supply Co. has played in the parade of events. W. A. Schlueter, who started the company in 1918, remains as its president and active manager.

Magoffin District Manager For Patterson-Ballagh

Patterson-Ballagh Corp., 1900 East Sixty-fifth Street, Los Angeles, Calif., announces the appointment of Jack P. Magoffin as district manager for

the company. He will be stationed at Houston, Tex. Mr. Magoffin was formerly with Hydril Co. for 12 years as field representative in the same area in which he will now be working. He succeeds J. M. O'Melveny.

Cameron Iron Works Announces Changes in Sales Personnel

Sam Pattillo, for the past 5 years Cameron Iron Works sales representative in Southwest Louisiana, has been

SAM PATTILLO

T. J. BUCHANAN

J. (DOC) McCANN

transferred to the South Texas area. For the present he will be located at Alice. J. J. (Doc) McCann has recently joined the Cameron sales staff, relieving Mr. Pattillo, and will be located at Lake Charles. Another newcomer to the Cameron organization is T. J. (Buck) Buchanan, who recently completed a tour of duty with the Seabees on Guadalcanal. Mr. Buchanan will represent Cameron in the West Texas area, making his headquarters at Odessa.

Cutler-Hammer Names Jones Sales Manager

P. S. JONES

Cutler-Hammer, Inc., Milwaukee, Wis., manufacturers of motor control apparatus, has announced the appointment of P. S. Jones as general sales manager for the company.

Mr. Jones first became associated with the company at Milwaukee as a sales engineer in 1915, and he was transferred to the Pittsburgh office in 1919, where he was later appointed as branch manager of the Pittsburgh sales territory. For the past 14 years prior to his new appointment he was in charge of the New York sales territory.

Burgess Assistant Sales Manager for Briggs Clarifier Co.

Briggs Clarifier Co., 1339 Wisconsin Avenue, Washington, D. C., has appointed E. K. Burgess as assistant sales manager. Mr. Burgess was graduated from Western Reserve University law school in 1930. He has been with the company for 2 years, the last 8 months as administration assistant to the general manager. Prior to his connection with Briggs, he was factory sales manager for Nash Motor Co., which concern he left due to the curtailment in the automotive industry.

Gustin-Bacon Announces Changes in Personnel

A. L. Gustin, Jr., has been elected president of Gustin-Bacon Manufacturing Co., Kansas City, Mo., as successor to A. L. Gustin, Sr., deceased. Other changes announced by Gustin-Bacon are as follows: J. F. Stephens, general manager of the industrial department, is vice president; J. D. Simmons has been elected to the board of directors.

The other officers of the company remain: J. W. Foyle, vice president; R. C. Harden is vice president in charge of the eastern division, and C. L. Higgins is secretary and treasurer.

The new president is 39 years old and is a graduate of Wharton School of Finance, University of Pennsylvania. He entered the Gustin-Bacon company in 1927 and became vice president in 1930.

Universal Atlas Appoints Three Technicians

Appointment of F. P. Diener, assistant general chemist of Universal Atlas Cement Co., as chemical engineer for that organization, has been announced by officials of this United States Steel Corp. subsidiary.

Mr. Diener, a graduate of Lehigh University, started with the company as an analytical chemist at Northampton plant in 1924.

Actively engaged since that time in chemical, analytical and engineering work, he was particularly concerned with the starting of operations at the plant of Universal Atlas at Waco, Tex.

Other appointments announced by the company included that of G. L. Lindsay, engineer of tests, to the position of assistant director of tests and research, and C. L. Davis, assistant engineer of tests, to engineer of tests.

McEVOY COMPANY AWARDED ARMY-NAVY "E"

McEvoy Co., Houston, Tex., has been awarded the Army-Navy "E," the ceremonies attending the award taking place at the plant. The organization has been active in the manufacture of oil-field equipment since 1906, and was awarded its first ordnance contract in 1940. Included in the contracts are the manufacture of such items as machine-gun mounts and airplane-landing cylinders.

Col. Merle H. Davis made the presentation, and Gus S. Wortham, president of the firm, accepted the award for the several hundred employes gathered. A surprise award to Robert Eichenberg, chief engineer, climaxed the program after the flag was ac-

Col. Merle H. Davis; W. O. Hedrick, and B. T. McNeil, vice presidents of McEvoy Co.; Lt. Comdr. James G. Clarke; Capt. George G. McDonald, and Gus G. Wortham, McEvoy president

cepted by a color guard from the plant's auxiliary military police. Token "E" pins were presented by Lt. Comdr. James G. Clarke to a committee of employes made up of J. A. Fairley, Mary Dee Belcher, Joe Cleboski and Wilda Vaughn.

Quigley Appoints Maples As Distributor

Quigley Co., Inc., 56 West Forty-fifth Street, New York, announces the appointment of Steve C. Maples & Co., of Pampa, Tex., and Tulsa, as distributors of Quigley products, which include refractory and insulating materials for the construction and maintenance of all types of industrial furnaces, acid-proof cements, joint-sealing and cleaning compounds, etc.

Kallenbaugh West Coast District Manager for Timken

S. R. Kallenbaugh has been appointed West Coast district manager of the steel and tube division, Timken Roller Bearing Co., Canton, Ohio, whose western offices are at 1526 South Olive Street, Los Angeles, Calif.

Mr. Kallenbaugh is a graduate of Mount Union College, and has had post-graduate training in metallurgy at Ohio State University. Until his recent transferral, he was metallurgical service representative for Timken in Cleveland and Detroit.

Robert L. Crook Rejoins Oil Well Supply Co.

Robert L. Crook has reentered the employ of Oil Well Supply Co., at San Antonio, Tex. Mr. Crook represented Oil Well in South America from 1933 until 1937. He had previously served as driller for British interests in Burma and for American companies in Argentina, Bolivia and Java, and as drilling superintendent in Borneo.

Jackson Heads Diesel Engineering for Alco

Lawrence B. Jackson has been appointed director of engineering, Diesel division, American Locomotive Co., effective October 1.

Mr. Jackson is a graduate of Stevens Institute of Technology, and after association with American Hawaiian S. S. Co. as superintending engineer and with Texas S. S. Co. as plant engineer at the Bath, Maine, shipyard and superintendent of technical division, marine department, he became associated with Fairbanks, Morse & Co. in 1925. In this organization he advanced through the ranks from the position of engineer, marine applications to the assignments of assistant chief engineer and chief engineer of the diesel division, manager, marine diesel sales, in Chicago and manager, New England (sales) branch at Boston, to the position of manager of engineering in 1936.

Mr. Jackson has contributed to various technical journals on subjects relating to internal-combustion engines, and is the inventor of an interlock hydraulic control for water-gas manufacturing and an exhaust silencer.

He is a member of the American Society of Mechanical Engineers, serving on the power code test committee, the Society of Automotive Engineers, Society of Naval Architects and Marine Engineers and is a member of the technical committee of the American Bureau of Shipping.

Insurance Co. Seeks Whereabouts of Hugh West

The present whereabouts of Hugh West, a former drilling contractor of Ardmore, Okla., is sought by Prudential Insurance Co., Newark, N. J., who reports that Mr. West has due him some cash values on insurance formerly carried in the company. The company is desirous of locating Mr. West in order that proper payment can be made. The company will be grateful if anyone knowing where Mr. West is currently located will notify it.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that the lands herein described within the known geologic structure of the Elk Basin field, Montana, are offered to qualified bidders of the highest amounts offered per acre as a bonus for the privilege of leasing the land under section 17 of the leasing act, as amended by the act of August 21, 1935 (49 Stat. 674, 30 U. S. C. 226), in the following parcels, all in T. 9 S., R. 23 E.: Parcel No. 1, lot 8 sec. 34, embracing 21.64 acres; Parcel No. 2, lot 9 sec. 35, embracing 11.48 acres; Parcel No. 3, lot 10 sec. 35, embracing 1.11 acres; Parcel No. 4, lot 11 sec. 35, embracing 3.96 acres; Parcel No. 5, lot 12 sec. 35, embracing 2.92 acres; Parcel No. 6, lot 13 sec. 35, embracing 2.68 acres; Parcel No. 7, lot 9 sec. 36, embracing 31.81 acres. Sealed bids will be received in the office of the Secretary of the Interior, Interior Building, Washington 25, D. C., up to 12:00 (noon) November 29, 1943. Bids must be submitted on each parcel separately, but if two or more parcels in sec. 35 are awarded to the same bidder, they may be included in a single lease. Each bidder must submit a certified check or cash for one-fifth of the amount bid, payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease required by section 7 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of $1 per acre, must be paid and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease, and the deposits of the other bidders will be returned. The envelopes should be plainly marked "Bid for Parcel No. ——, Elk Basin Field. Not to be opened before noon November 29, 1943." No bid received after the time fixed herein for submitting bids will be considered. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

LEGAL

OIL AND GAS LEASE

UNITED STATES DEPARTMENT OF AGRICULTURE, Soil Conservation Service, Upper Darby, Pennsylvania, November 2, 1943. Sealed bids in triplicate will be received until 2:00 P.M. E.W.T., December 17, 1943, and then publicly opened, offering bonus for operating rights in connection with oil and gas leases on approximately 2336.88 acres of land located in the northern portion of the Town of Hector, Schuyler County, New York. Award of lease will be made only to bidder who can show sufficient experience and financial resources and prove citizenship. Interested parties may obtain bid documents, lease forms, and operating regulations from the Soil Conservation Service, Upper Darby, Pennsylvania. Inspection of the property may be made upon application at the project headquarters, approximately five miles west of Trumansburg, New York.

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